THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL

Edited by JOSEPH HUGHES.

'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

VOL. III. No. 7. SEPTEMBER, 1883. PRICE 6D. POST FREE, 7½D.

The Teacher's Health.

BY ALFRED CARPENTER, M.D. (LOND.), M.R.C.P. (LOND.), C.S.S. (CAMB.),

Vice-President of the British Medical Association.

HEARING AND THE EARS.

DEAFNESS is a terrible misfortune to teachers; it may be caused by functional derangement and be temporary, or it may arise from actual disease, and then may be either temporary or permanent.

The organ of hearing consists of a number of parts, which are most complex and elaborate in their character and construction. The external ear is simple enough, but the arrangement of parts in the internal ear are so intricate that it is perfectly impossible to make them understood without models and a considerable acquaintance with the laws which regulate acoustics, and it is no part of my plan to go into the physiology of hearing; but I may state that vibrations of the air are conveyed by the external ear and by the auditory canal to the tympanum or drum, which stretches across the bottom of the auditory canal, and apparenty limits its length. The rays or currents of sound collected by the external ear impinge upon the tympanum and cause vibrations, which are felt by the ossiculæ or little bones on the other side of the drum, with which they are in direct contact. This chain of bones conveys the vibrations to the auditory nerve, the sound being reverberated and magnified by passing along a series of canals or passages, some filled with air, others with fluids of varying densities, until the tremor of the sound itself reaches the expansion of the 'portio mollis,' the most sensitive part of the seventh pair of nerves, and by it the impression is conveyed to the brain.

The ear is divided into the external, middle, and internal ear. The drum is a membrane at the bottom of the passage, which leads into the head from the concha or external ear. It divides the middle from the external ear. The middle ear is not, however, shut off from direct communication with the outer world, for it receives air from the throat by means of a passage called the Eustachian tube. It contains a series of contrivances for multiplying sound, which are wonderfully protected from injury, and which, when injured or displaced, lead to deafness, greater or less in intensity according to the damage which has been done. This small cavity—less than half a cubic inch in size—has a chain of bones of very defined angular and branching construction, with ligaments, muscles, and nerves, which are excessively delicate. Interference with their faculties induces disturbance of function. The lining membrane of this cavity is highly sensitive and vascular; it is continuous with the membrane in the throat by the Eustachian tube. That in the tube is covered with vibratile cilia and mucus glands, which pour out a thick secretion, but that lining the tympanum itself has neither cilia or mucus follicles. The internal ear is in the structure of the temporal bone. It is wonderfully protected. It contains the most sensory part of the ear. There are several canals placed at different angles—a vestibule into which the canals open, winding staircases (the cochlea or shell), sounding membranes, with a clear fluid in which the membranes lie, all being most intricate in structure, and enclosed in bones called collectively the osseous labyrinth. The parts with which we have more particularly to deal are the external ear and the Eustachian tube at its opening in the throat. Disturbances and diseases of the middle and internal ear are among the most dangerous of the ills to which the human body is liable, and only call for mention in this place. The most serious are those connected with inflammation of any part of it, giving rise to effusion or abscess. Convulsions, coma, and death result, unless the effused fluid quickly makes its way out by one of the possible openings. The diseases and disorders which I propose to deal with may be divided into two classes—those connected with the external ear and those connected with the throat. The ear may be likened to a trumpet reversed, the narrow part being in contact with the tympanum. The passage called the external meatus may be stopped up by excess of secretion, by foreign bodies, or by unnatural growths. The meatus is lined with excessively fine hairs, and is kept from dryness by a secretion of glutinous matter, which is usually called wax; if it becomes inspissated and adherent to the hairs, it forms a plug, which may effectually prevent the admission of the waves of sound, and prevent them from impinging upon the drums, thus producing deafness. The same condition arises

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from the admission of dust, fluff, or pieces of cotton wool, which are sometimes designedly inserted to keep out the cold. This state of things is very often a cause for *ear-ache*. If a person having such a plug in the ear happens to bathe or admits water into the ear by any means whatever so that the plug swells up, it presses upon the sensitive parts of the organ, sometimes producing the most acute suffering, and effectually prevents the access of sound to the tympanum.

Ear-ache of this kind is remedied by hot fomentations, such as bran poultices and the use of a douche, or syringing out the ear with warm soapy water, until the offending plug is extracted. I have sometimes removed plugs as large as a Minie rifle bullet. Earache also arises from cold; a swelling of some of the follicles takes place, or a minute herpetic eruption may come out, such as is accustomed to appear under similar circumstances upon the lips. Time and a little sweet oil are the only things necessary for the treatment of this class, unless the herpetic spots should be large in size or proceed to suppuration. Then the action of the jaws, as in masticating, is painful, and the general health is much disturbed; warm fomentations and such treatment as may establish a diaphoresis (or a good sweating) is the best course to be followed. Earache arises also from an exzematous state of the skin. It is usually a part of a more general disease, and must be treated as directed under the head of *Eczema* in 'School Surgery.' An absence of proper secretion also causes deafness; the meatus is dry and shining, so that there is no proper conveyance of sound. This is remedied by the frequent insertion of a drop of almond oil, with a particle of glycerine, or a drop or two of Friar's balsam, dropped carefully into the passage, and the ear syringed out every day with warm, soft water.

Earache is often associated with dentition, as when the molars are being developed, especially the wisdom set. There is generally some error of diet connected with this disturbance. A filament from the carotid plexus of the great sympathetic nerve is connected with the plexus of nerves called the tympanic plexus, and a small branch called the posterior auricular from the pneumogastric, ramifies on the back of the external ear. These branches connect the organ with the great nerve of digestion. This is popularly known to be the case, as, when any person's ears are seen to be excessively turgid, it is said that he is suffering from the effects of indigestion. A legend is attached to the condition in some parts of the kingdom, and it is said that somebody is walking over the sufferer's grave, or is talking about that particular person at that particular moment; it is, in reality, an evidence of indigestion. This condition is liable to set up various disorders, such as temporary deafness, ringing noises and different sounds in the ears, with headache and the other accompaniments of indigestion, or it may culminate in apoplexy. Treatment must be directed to the first cause, viz., the digestive organs, and not to the ears. *Neuralgic ear-ache* may be produced by decayed teeth irritating the ganglia in the ears, which are closely connected with the dental nerves, as well as with the facial, which are distributed to the skin of the side of the face, and which are especially liable to be influenced by cold blasts of air. This form of earache must be treated in the same manner as similar neuralgic conditions elsewhere. It is often kept up by miasms and unhealthy habits of life. The cause must be removed in preference to the use of remedies, which often give relief for the moment, but which make the disease more permanent. Stimulants, such as wine and spirits, and narcotics, such as chloral, opium, and morphia, are to be avoided as deadly poisons: They lull the sufferer by paralysing the nerve which is the source of pain; they do nothing whatever towards removing the cause of the disease, but, on the contrary, the cause becomes rooted, so that the disease itself is more and more confirmed according as the sedative or narcotic is indulged in to a greater or less extent.

Ordinary ear-ache of a neuralgic character, or that which arises from any of the preceding causes, may be distinguished from inflammatory affections by the absence of fever, the pain being of a shooting rather than of a throbbing kind, by its sudden onset, and by its intermittent character. The neuralgic form is sometimes called *Otalgia*, to distinguish it from *otitis*, or inflammation of the ear.

Otorrhœa, or purulent discharges from the meatus, sometimes of the most offensive character, are not uncommon; indeed, they are frequent complaints among children. They follow upon blows which have set up hæmorrhage into the middle ear, or other injuries which have caused the ossiculæ to be dislocated and to necrose or die. The retention of decomposing pieces of inspissated wax is sometimes the cause of the discharge, or some foreign body, such as the dead body of some insect or other animal, which has been lodged in the ear. The chrysalis of an insect may develop from some ova laid in the felt-like mass which occasionally occupies the meatus, fungi may grow there and produce evil, or one of the little bones being dead and retained by its ligaments, acts as a foreign body and sets up the peculiarly offensive discharge indicative of dead bone. Sometimes there is no foreign body or dead bone in the passage, the discharge being associated with a strumous or tubercular habit of body. It is then muco-purulent in its character, and proceeds from the mucus or cutaneous surface of the meatus. In all these forms of the complaint the greatest care is necessary that there be extreme cleanliness. The ear should be frequently washed with some disinfecting solution, such as Condy's fluid (a teaspoonful in a tumbler of water) or carbolic soap, and afterwards anointed with carbolised oil, whilst the general health must be rigorously attended to.

There is another class of cases which are extremely dangerous, which have supervened upon scarlatina or some other of the diseases caused by blood poisoning, and which are associated with caries of the portion of the temporal bone, which encloses the sensory part of the organ of hearing. They are in the end generally fatal, and should be always under the care of a medical man.

The external ear is often liable to so-called *tophi* or gouty concretions; a deposit of gouty matter (urate of soda) takes place in the tissue of the auricle, which shows as a white deposit after the inflammation which it causes at first has subsided. It is better to leave them alone and to treat the gout by general means.

Polypi sometimes form in the ear. These growths are usually hard and fleshy-looking, or they may be soft and gelatinous. The surgeon will easily remove them by means of forceps and a wire snare. They require to have the base from which they have been

removed touched occasionally with a little nitrate of silver, and the passage syringed out with carbolised water every day for some time after their removal.

Obstruction of the *Eustachian tube.* This is often a cause of deafness. It is necessary for perfect hearing that air should be conveyed from the mouth into the cavity of the tympanum. If the channel is obstructed, more or less deafness results. The opening of the tube is situated in the throat behind and above the soft palate and tonsil, and in close proximity to the posterior nares. The trumpet-shaped opening is covered with columnar and ciliated epithelium, which secrete and convey mucus from the ear to the throat. A relaxed throat or simple cold causes deafness by leading to an obstruction in the canal; the character of the secretion is altered just as arises in the nasal organ when its faculty is interfered with. Deafness also may arise from ulcers in the throat; it follows upon the sloughing which sometimes occurs in different forms of sore throat, also in scarlatina and diphtheria. It may be caused by the descent of a nasal polypus from before backwards, and enlarged tonsils may block up the passage and prevent perfect hearing. All these conditions impair, but do not destroy, the hearing. They are all capable of diminution by appropriate treatment. The effects of the cold will disappear in the course of time. The cause for the ulceration must be searched out, and, if constitutional, it must be treated properly. The polypus must be removed by the surgeon, the condition which gives rise to enlarged tonsils remedied. The local application of tannate of glycerine to the throat above each tonsil will often be successful in getting rid of depraved secretion, and will cure the relaxation upon which it may depend. Much may be done by local and constitutional treatment, but instrumental interference as occasionally practised more often leads to further deafness than remedies that which already exists. I have never met with a single person who has been really cured by the passage of instruments into the tube, but I have met with some who have been evidently made worse, and sometimes irretrievably damaged, by such treatment.

Surgical interference, except of the simplest character and for the purpose of removing extraneous bodies or distinct polypi, is to be deprecated.

Deafness may be considered under three heads:—(1) That in which the faculty is completely annihilated. (2) Hardness of hearing in which articulated sounds cannot be heard without artificial assistance. (3) Alteration or diminution of hearing in which there is want of precision.

(To be continued.)

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Lessons in English.

BY ALEXANDER BAIN, LL.D.,
Author of "Education as a Science."

XIII.—Emotional Qualities of Style.

The present lesson will be devoted to the Quality of Pathos. References have already been made to that quality, to its foundations in our Tender Feeling, and to the difficulties attending its embodiment.

It may have been gathered from various remarks scattered over the previous lessons, that the Tender or Loving side of our nature is made alive or awake by various causes: as the relations of the sexes, the parental relations, the tribal or social relations, friendship, and occasions of beneficence. Poetry operates powerfully in moving us through all these sources. By the love tale, our amatory feelings are kindled into agreeable activity. When the affection is prosperous, the interest is all on the side of pleasure; when there are reverses or disasters attending the affections, we are still interested; the pain operating on the fountains of tenderness draws out a pleasing and soothing influence, to which we give the names—pity, sorrow, sympathetic grief. As rendered in Poetry, this is Pathos, in the best sense of the term.

A notable incident in our country's history, namely, the melancholy death of the Princess Charlotte, in 1817, gave occasion to innumerable outbursts of sympathetic sorrow. Our universal pulpit embraced the theme, and the discourses of the two most famous preachers of the time—Hall and Chalmers—still survive as Literature. Byron was in the act of finishing *Childe Harold;* his mind was deeply agitated by the fate of the Royal Princess, and he introduced into the poem his well-known episode (Fourth canto, stanzas 166—172), which we may probably regard as the greatest, in point of Pathos, of all the contributions to the mournful occasion. This passage we shall select as an illustrative lesson.

> Hark! forth from the abyss a voice proceeds,
> A long low distant murmur of dread sound,
> Such as arises when a nation bleeds
> With some deep and immedicable wound;

The poet prepares for us a grand and awful situation, to start from—the opening of the abyss, and the emergence of a voice—the sound made impressive by a number of epithets, all easily realisable. Strength with awe is the characteristic of the picture. Next is the shadowing forth of the main subject in the form of a terse and powerful comparison: "as when with deep immedicable wound a nation bleeds." There is a felicity of condensation in the whole device.

> Through storm and darkness yawns the rending ground,
> The gulf is thick with phantoms, but the chief
> Seems royal still, though with her head discrowned,
> And pale, but lovely, with maternal grief
> She clasps a babe, to whom her breast yields no relief.

We have still the continuation of the sublime and terrible picture; storm and darkness being superadded to the abyss. Then comes a host of phantoms; these we are dimly to conceive, while singling out the chief of them all; the description of which in the three last lines passes from strength to pathos. The discrowned royalty is still an image of strength and elevation; even a negative does not at once destroy that effect. The two concluding lines are the purest pathos. All the circumstances of the maternal relationship are at their utmost stretch—it being the moment of giving birth; while the double tragedy immerses the onlooker in sympathetic grief. The picturing epithets—pale, lovely, clasping to the breast—enhance the situation by no mere common-place string of words: they all belong to the vocabulary of pure pathos. The sympathy for the affliction or prostration is increased by the personal beauty and all the interesting adjuncts or qualities of the object: hence the special force of "lovely" as an epithet. Farther examples will occur presently.

Scion of chiefs and monarchs, where art thou?
Fond hope of many nations, art thou dead?
Could not the grave forget thee, and lay low
Some less majestic, less beloved head?

The figure of Interrogation is here appropriate. Then as to the thought, it is impossible to avoid the piquant contrast of high worldly position in the premature embrace of death. The first line is not so much pathos as a painful shock of surprise, taking the direction of humbling the proud, and increasing the sense of insecurity as against death. The second line has real pathos, from the altered turn of the thought; instead of "scion of chiefs and monarchs" suggestive of pride, it is "fond hope of many nations" implying a widespread affection and sense of deprivation. The third and fourth lines but enhance the ideas of contrast in the first and second.

In the sad midnight, while thy heart still bled,
The mother of a moment, o'er thy boy,
Death hush'd that pang for ever: with thee fled
The present happiness and promised joy
Which filled the imperial isles so full it seem'd to cloy.

This is a recurrence to the pathos of the situation, with a new setting. The stern fact is given again; and is followed up with the iteration of the national bereavement. The expression of the whole is intensified under the poet's second touch. The third stanza sustains the sad theme, with some additions.

Peasants bring forth in safety.—Can it be,
Oh thou that wert so happy, so adored!

This of course is an exaggeration; peasants suffer in the same way, and even more than princesses. The poetic value is also doubtful. The safe line would be to take the high and the low on an equality in such risks; if not strictly correct, it is sufficiently so for the moral effect. The second line again enhances the sympathetic sorrow; so "happy," so "adored"; the unhappy and the neglected we pass carelessly by, in their grief.

Those who weep not for kings shall weep for thee.
And Freedom's heart, grown heavy, cease to hoard
Her many griefs for ONE; for she had pour'd
Her orisons for thee, and o'er thy head
Beheld her Iris.—

This is a change of view. The poet sees in the future of the expected succession to the crown a new guarantee for our political liberties: and mourns the princess at the expense of her parentage. The allusion has touches of poetical force allied to pathos, but it is brief to the point of obscurity. In the outpourings of prose on the occasion, this point would be frequently made prominent; and it is well suited to a prose handling. But it is somewhat removed from the extreme pathos of the situation. The element of gratitude for promised political good and of chagrin for the failure of the promise, undoubtedly lands us in regrets and self-pity, containing, however, but a small portion of the purest tender feeling:

Thou, too, lonely lord,
And desolate consort—vainly wert thou wed!
The husband of a year! the father of the dead!

This is the pathetic mourning for the husband, who, as the survivor, comes in for a share of pity. It can scarcely be called comfort: it is an all too energetic expression of his sad bereavement; an energy very natural to the author, but not yielding solace to the victim. The theme is continued in the two first lines of the stanza following:—

Of sackcloth was thy wedding garment made;
The bridal's fruit is ashes;

Much too energetic and severe; without one softening touch. Such language only aggravates the painful part of grief; better let the sufferer pass by in silence.

—in the dust
The fair-haired daughter of the Isles is laid,
The love of millions!

The finish to the apostrophe to the bridegroom, and scarcely introducing any ray of comfort. There is a repetition of the pathos of beauty and belovedness; yet bringing to the comfort of the husband nothing but what he might extract from the attachment and grief of the nation.

How did we intrust
Futurity to her! and though it must
Darken above our bones, yet fondly deem'd
Our children should obey her child, and bless'd
Her and her hoped-for seed, whose promise seem'd
Like stars to shepherd's eyes:—'twas but a meteor beam'd.

For the third time the poet expatiates on this theme—the national hopes founded on the birth that ended in death. The expression attains now its highest pitch; and the circumstances are highly charged with the pathetic and tender interest. The fine figure—"like stars to shepherd's eyes"—has an element of grandeur yet not in discord with the tones of affection preceding. The concluding clause—"'twas but a meteor beam'd"—gives the tragic fact with somewhat needless iteration, and no redeeming comfort.

We have now a stanza of attenuation of the hard fate of the princess.

Woe unto us, not her: for she sleeps well:

A fine line in itself; the everlasting pathos of a few simple terms, as a consequence of their thorough appropriateness. The remainder of the stanza is a highly-wrought picture of the perils and hard fate of monarchs; the tragic strength so much more congenial to Byron than pathos. The pretext is to furnish a contrast to a different picture to follow.

The fickle reek of popular breath, the tongue
Of hollow counsel, the false oracle,
Which from the birth of monarchy hath rung
Its knell in princely ears, till the o'erstung
Natives have armed in madness, the strange fate
Which humbles mightiest sovereigns, and hath flung
Against their blind omnipotence a weight
Within the opposing scale, which crushes soon or late,—

This splendid denunciation of the enemies that sovereignty has to contend against, rests on its own independent merits, and is out of the line of the pathetic wail for the princess. The selection and accumulation of impressive circumstances, heightened by the poet's strength of imagery, would stand criticism as vituperative oratory. Its ostensible place in the present passage is to act as a contrast to a truly pathetic description. Like many such contrasts, it is needlessly worked out, as far as the purpose is concerned. Let us glance at the next stanza.

These might have been her destiny; but no,
Our hearts deny it: and so young, so fair,
Good without effort, great without a foe!

So far this is well. There is pathos in all the circumstances, although with some iteration. We have seen her as 'fair': we have now her youth: and next her goodness epigrammatically pointed; the epigram, however, is more allied to energy than to pathos. Nevertheless, there is a nobility in the thought expressed in the third line, and it does not jar with the general effect.

But now a bride and mother—and now *there!*

The poet cannot help falling back once more upon the shock of the transition, which he puts with his usual energetic brevity. He makes it the starting-point of a new outburst, mingling strength with real pathos.

How many ties did that stern moment tear!
From thy Sire's to his humblest subject's breast
Is linked the electric chain of that despair,
Whose shock was as an earthquake's, and opprest
The land which loved thee so that none could love thee best.

This repeats with a bold figure both the numerous relationships of the princess, and the intensity of them all, including once more the attachment of the nation at large. Any picture of intense affection inspires our sympathetic tenderness, and prepares us for the sorrow and grief of a calamitous rupture. In so far as the whole effect redeems the misery of the contemplation, it is pathos in the highest sense.

Reviewing now the passage as a whole, we cannot help being struck with its richness of handling, with the superabundance of effects of Strength, intermingled with genuine Pathos. We are also arrested by the lack of consecutive arrangement. Instead of working up each thought continuously and fully, the poet comes back again and again upon the same point, improving the impression each time. This would be bad in prose, and it detracts from the merit of poetry, although not incompatible with very high effects. If any great poet had bestowed his pains upon an Ode on the occasion, he would probably have kept each stanza to a distinct point in the situation; but Byron probably dashed off the passage hastily, and it has merits sufficient to give it a place in his poem; while the casual reader is not struck with the defects of order. There can be little doubt, nevertheless, that the same grandeur of imagery in a better arrangement would have impressed us far more, although we might not be conscious of the reason of the superiority.

The mixing of pathos with strength and tragic horror is not peculiar to Byron, although suitable to his genius and temperament.

We shall now avail ourselves of the eminently instructive efficacy of comparison for a lesson in criticism as for other things. Among the numerous effusions on the same event, we may single out, first, the well-known sermon of Robert Hall. Happily the material for the comparison does not exceed a quotable passage, where the preacher aims at setting forth the pathetic aspects of the occasion.

He begins with a sketch of the lofty situation, high character, and splendid hopes of the princess; all managed so as to excite our friendly interest. More especially touching are these expressions:—"To a "grandeur of mind suited to her royal birth and lofty "destination, she joined an exquisite taste for the "beauties of nature and the charms of retirement; "when, far from the gaze of the multitude, and the "frivolous agitations of fashionable life, she employed "her hours in visiting, with her distinguished consort, "the cottages of the poor, in improving her virtues, in "perfecting her reason, and acquiring the knowledge "best adapted to qualify her for the possession of "power and the cares of empire." This has too much of the author's stately manner to lend itself at once to pathos; but it is all strictly to the point. Still better is the paragraph that succeeds, although that too is but preparatory. The princess is represented as anticipating "a long series of years, and expecting to be led "through successive scenes of enchantment, rising "above each other in fascination and beauty." "Her "heart would often be ruffled with emotions of trembling "ecstacy, when she reflected that it was her province to "live entirely for others, to compose the felicity of a "great people, to move in a sphere which would afford "scope for the exercise of philanthropy the most "enlarged, of wisdom the most enlightened; and that "she was to supply the materials of history, and to im-"part that impulse to society, which was to decide the "destiny of future generations. Fired with the ambi-"tion of equalling, or surpassing, the most distinguished "of her predecessors, she probably did not despair of "reviving the remembrance of the brightest parts of "their story; and of once more attaching the epoch of "British glory to the annals of a female reign. It is "needless to add that the nation went with her, and "probably outstripped her, in these delightful anticipa-"tions. We fondly hoped that a life so inestimable "would be protracted to a distant period, and that, "after diffusing the blessings of a just and enlightened "administration, and being surrounded by a numerous "progeny, she would, gradually, in a good old age, sink "under the horizon, amidst the embraces of her family "and the benedictions of her country. But, alas! these "delightful visions are fled, and what do we behold in "their room, but the funeral pall and shroud, a palace "in mourning, a nation in tears, and the shadow of "death settled over both like a cloud!"

The expression here grows in pathetic adjuncts to the end. The sympathies of the nation are effectively handled for the purpose. The concluding sentence announces the catastrophe in selected circumstances and language of the most impressive kind. For such a tragic occasion, the painful side of grief must preponderate; nevertheless, the grandeur of the expression has the soothing influence that the genius of the poet evokes from calamitous situations.

The preacher's pathos attains its height in his sympathy for the bereaved parents and husband. It would be difficult to surpass the tender interest awakened in this passage.

"How must the heart of the royal parent be torn with "anguish on this occasion; deprived of a daughter, who com-"bined every quality suited to engage his affection and elevate "his hopes; an only child, the heir of his throne; and doomed, "apparently, to behold the sceptre pass from his posterity into "other hands; his sorrow must be such as words are inadequate "to portray. Nor is it possible to withhold our tender sympathy "from the unhappy mother, who, in addition to the wounds she "has received by the loss of her nearest relations, and by still "more trying vicissitudes, has witnessed the extinction of her last "hope, in the sudden removal of one in whose bosom she might "naturally hope to repose her griefs, and find a peaceful haven "from the storms of life and the tossings of the ocean. But "above all, the illustrious consort of this lamented Princess is "entitled to the deepest commiseration. How mysterious are "the ways of Providence, in rendering the virtues of this dis-"tinguished personage the source of his greatest trials! By these "he merited the distinction to which monarchs aspired in vain,

"and by these he exposed himself to a reverse of fortune, the "severity of which can only be adequately estimated by this "illustrious mourner. These virtues, however, will not be per- "mitted to lose their reward. They will find it in the general "attachment of the British nation, in the remembrance of his "having contributed the principal share to the happiness of the "most amiable and exalted of women."

The other great preacher of the period, Thomas Chalmers, touched the same situation in a somewhat more condensed passage, which it is interesting to compare with the foregoing. Chalmers had a more prolific imagination than Hall, but not the same elegance or polish. After adverting to the want of access of the general public to the inner or domestic life of royalty, Chalmers proceeds :—

"Now, if through an accidental opening, the public should be "favoured with a domestic exhibition,—if, by some overpowering "visitation of Providence upon an illustrious family, the members "of it should come to be recognised as the partakers of one "common humanity with ourselves—if, instead of beholding "them in their gorgeousness as princes, we look to them in the "natural evolution of their sensibilities as men—if the stately "palace should be turned into a house of mourning—in one "word, if death should do what he has already done,—he has "met the Princess of England in the prime and promise of her "days, and as she was, moving onward on her march to a "hereditary throne, he has laid her at his feet! Ah! my "brethren, when the imagination dwells on that bed where the "remains of departed youth and departed infancy are lying— "when, instead of crowns and canopies of grandeur, it looks to "the forlorn husband, and the weeping father, and the human "feelings which agitate their bosom, and the human tears which "flow down their cheeks, and all such symptoms of deep afflic- "tion as bespeak the workings of suffering and dejected nature— "what ought to be, and what actually is, the feeling of the "country at so sad an exhibition? It is just the feeling of the "domestics and the labourers at Claremont. All is soft and "tender as womanhood. Nor is there a peasant in our land, "who is not touched to the very heart when he thinks of the un- "happy stranger who is now spending his days in grief and his "nights in sleeplessness—as he mourns alone in his darkened "chamber, and refuses to be comforted—as he turns in vain for "rest to his troubled feelings, and cannot find it—as he gazes on "the memorials of an affection that blessed the brightest, "happiest, shortest year of his existence—as he looks back on "the endearments of the bygone months, and the thought that "they have for ever fleeted away from him, turns all to agony— "as he looks forward on the blighted prospect of this world's "pilgrimage, and feels that all which bound him to existence, is "now torn irretrievably away from him! There is not a British "heart that does not feel to this interesting visitor, all the force "and all the tenderness of a most affecting relationship; and, go "where he may, will he ever be recognised and cherished as a "much-loved member of the British family."

This is tender feeling, as grief and sorrow, expressed with a power and freshness of language that saves it from maudlin, notwithstanding the intensity. All the pertinent circumstances are touched, as in Byron and in Hall; while the speaker is peculiar in his endeavour to put the royal family and ourselves upon a level of sympathising intimacy. The contrast of the greatness and the fall is fully expressed. The concrete embodiment of grief is powerfully marked out, as in Hall—"the forlorn husband, and the weeping father." The melancholy fate of the husband is dwelt upon with every circumstance that can evoke our tender interest; and the responsive sympathy of the British people put forward as a solace and consolation.

The comparison of these two passages with Byron is an instructive lesson in itself. For one thing, the prose of both is much better in point of arrangement: Byron's irregularity in this respect would not be allowed in the most impassioned prose. The poet's advantage lies in the growing intensity of his language at each repetition. In sustained gush, Chalmers carries away the palm; the strength of his own feelings being probably the explanation.

From any one of the foregoing examples, and still better from a comparison of the three, the student can see the modes of pathetic expression under a great domestic calamity. The salient points are seized alike by all three great writers; while each has his strong and weak points, as shown in the minute analysis.

The incident now chosen for exemplifying Pathos is an extreme case; it can hardly be overdone; and no one would approach it without being moved by a genuine inspiration. The miscarriages of the tender passion are better shown on less exciting occasions. One instance is furnished by Chalmers in his sermon on Cruelty to Animals. His tendency to exaggeration is here unsupported by corresponding strength of real feeling.

The following sentences are fairly admissible as both true and impressive :—

"These poor animals just look, and tremble, and give forth "the very indications of suffering that we do. Theirs is the dis- "tinct cry of pain. Theirs is the unequivocal physiognomy of "pain. They put on the same aspect of terror on the demonstra- "tions of a menaced blow. They exhibit the same distortions of "agony after the infliction of it. The bruise, or the burn, or the "fracture, or the deep incision, or the fierce encounter with one of "equal or superior strength, just affects them similarly to ourselves. "Their blood circulates as ours. They have pulsations in various "parts of the body like ours. They sicken, and they grow feeble "with age; and, finally, they die just as we do. They possess "the same feelings; and, what exposes them to like suffering "from another quarter, they possess the same instincts with our "own species. The lioness robbed of her whelps causes the "wilderness to ring aloud with the proclamation of her wrongs; "or the bird whose little household has been stolen, fills and "saddens all the grove with melodies of deepest pathos."

The orator is now carried away, not by his feelings, but by the strength of his language, into a strain of palpable exaggeration, which utterly defeats his purpose.

"Theirs is unmixed and unmitigated pain—the agonies of "martyrdom, without the alleviation of the hopes and the senti- "ments, whereof they are incapable. When they lay them down "to die, their only fellowship is with suffering; for in the prison- "house of their beset and bounded faculties, there can no relief be "afforded by communion with other interests or other things. "The attention does not lighten their distress as it does that of "man, by carrying off his spirit from that existing pungency and "pressure which might else be overwhelming. There is but "room in their mysterious economy for one inmate; and that is, "the absorbing sense of their own single and concentrated anguish. "And so in that bed of torment, whereon the wounded animal "lingers and expires, there is an unexplored depth and intensity of "suffering which the poor dumb animal itself cannot tell, and "against which it can offer no remonstrance; an untold and "unknown amount of wretchedness, of which no articulate voice "gives utterance. But there is an eloquence in its silence; and "the very shroud which disguises it, only serves to aggravate its "horrors."

The smallest discernment will show that this cannot be either true or probable. It is a study of hyperbole carried to the pitch of extravagance and failure. A certain amount of heightening is permissible both in poetry and in oratory: and the first quoted extract is not too much; the second is beyond all bounds of credibility, while, as imagination, it is not pleasing, but the reverse.

For domestic pathos kept within limits, and, on that account, producing its full effect, we may refer to

Cowper's piece entitled—"On the receipt of his mother's picture." In all the examples that we have been considering, the tender feeling is disturbed by imagery more or less alien to it; which cannot be said of the following lines, nor indeed of any part of the poem:—

My mother! when I learned that thou wast dead,
Say, wast thou conscious of the tears I shed?
Hovered thy spirit o'er thy sorrowing son,
Wretch even then, life's journey just begun?
Perhaps thou gav'st me, though unfelt, a kiss;
Perhaps a tear, if souls can weep in bliss,
Ah, that maternal smile! it answers—Yes.
I heard the bell tolled on thy burial-day,
I saw the hearse that bore thee slow away,
And, turning from my nursery window, drew
A long, long sigh, and wept a last adieu!

The vocabulary and the circumstances of pathos are sustained in every line; while there is a temperance in the passion that satisfies the most fastidious taste.

In the point of expressing tender emotion with the reserve that secures our thorough sympathy, Cowper passes a still greater ordeal, in taking as a theme the Love of Country. We necessarily feel a certain amount of warm attachment to our country, but it is scarcely a case for tender feeling pure and simple; so many other sentiments concur. Cowper takes the just measure of the case, in his "Love of England," and is still more sternly reserved in his "English Liberty." He has happily combined poetry with sober-minded patriotism, in his famous line—

"England, with all thy faults, I love thee still."

The genius of Campbell has adorned many sorrowful tales, and evoked pathos of the healing kind: he being well aware that pain and horror cannot be a poet's subject unless duly atoned. His "Lord Ullin's Daughter" is redeemed by the love affection of the bright and youthful pair; to which is added the father's melting with pity and forgiveness as he beholds the peril of his child. The self-devotion of the boatman, in the service of the "winsome lady" adds to the volume of tenderness that reconciles us to the perusal of the sad story.

The pathos of the "Dying Gladiator" is not of the purest type. The horror is redeemed, if at all, by the forecast of vengeance when Rome should perish under the shock of the gladiator's countrymen. This is the stirring of the malevolent side of our emotional nature, which has its own pleasures, equally at the command of the poet, but not, in any sense, describable as pathos.

(To be continued.)

—o—

The New Class-Subject, 'Elementary Science.'

(What to teach, and how to teach it.)

BY RICHARD BALCHIN.

I HAVE been asked whether it is not an undesirable thing to take 'Elementary Science' to the exclusion of such a useful and necessary subject as Geography, and whether it would not be a very unsatisfactory state of things for a boy to pass through his school course without obtaining a knowledge of even his own country. In answer to this, I may say that by the new code—I mean the Mundella Code—we are at liberty to take Elementary Science in the lower division, *i.e.*, Standards I. to IV., and Geography in the upper division, *i.e.*, Standards V. to VII. 'Grammar,' or rather 'English,' is compulsory throughout the school. I presume that where 'Elementary Science' is taught as a class-subject the arrangement will be somewhat as follows:—'English' throughout the school; 'Science' the same, but as a *class*-subject in the lower division, and as *specifics* in the upper, where the 2nd class-subject will be Geography. By this plan the scholars throughout their whole school course will acquire: (1) ideas, (2) the ability to express them.

In last month's PRACTICAL TEACHER will be found a syllabus of lessons in this subject for Standard II. I propose reproducing the first of them, viz., that on the 'Meaning and Use of Classification.'

OUTLINE OF LESSON.—Boys to classify a few groups of objects, *i.e.*, pens, stones, etc. Slips of paper, on which are written nouns, verbs, adjectives, etc. Objects in the fields. Lead to the conclusion that all in one class are alike in some respects, and that those in one class differ in certain particulars from those in another. Hence that classification shows the *likenesses* and *un*likenesses among the objects around us.

OBJECTS EXHIBITED.—A bundle of pens. A number of small pieces of stone of various kinds, *i.e.*, granite, flint, chalk, etc. About thirty slips of paper, on each of which is written a noun, or verb, or adjective, with a sentence in which the word is used as such.

(*Note.*—I find this an exceedingly useful way of teaching little children the 'parts of speech,' which, of course, is simply a classification of words. I wonder some publisher has not thought of getting out packets of such.)

THE LESSON.—Here, boys, we have a lot of pens of all kinds mixed up together. I want them arranged. Jones, you come and pick out all the new ones with nibs in them; Smith, you find all those that have no nibs; and Cox, you look in Smith's lot for all those that have broken holders. While these boys are doing that, we will have three more of you out here; just to arrange these pieces of stone. Ardy, you find out all that are like this piece of granite; this little boy will place all the pieces of chalk by themselves, and White will look out the flints. Now set to work, while all the rest of us will look on. Has any one finished? Ans. (Jones).—Yes, sir; we have done the pens. What do you mean, Jones, by 'done the pens'? Ans.—We have put the different kinds by themselves. And so have I, sir; I've finished the flints. What do *you* mean, White, by 'finished the flints'? Ans.—I have put them apart from the others, and Ardy has picked out the granite. Very well, you have all done; now go to your places. Now, boys, Jones says he has 'done the pens,' and White says he has 'finished the flints'; what is it they mean? Ans.—They have been putting the same ones altogether by themselves. Yes, they have; we call that 'classifying'—a word I will write on the board. Some boys have been classifying the pens. What have others been doing with the pieces of stone? Ans.—Classifying them. Do you know of any other things that we arrange in classes? Ans.—Yes, sir, *we* are; there's a class of boys going downstairs. Ah! so there is. Can you tell me *why* Ardy placed *these* stones by themselves? Ans.—Because they are all alike. Very good. Are they different from

the others? Ans.—Yes, sir; they are not like the flint or the chalk. Just so; then we may say they are *like* among themselves, but *unlike* the rest. Are those boys that were going downstairs alike in any respect? Ans. (Smith).—Yes, sir; they are all 'duffers.' Stop! stop! Smith. Don't say that. Ans. (Smith).—Yes, sir, that is what the teacher calls them. They have just come into the First Standard, and they don't know their letters; so they are going downstairs to be worked up by themselves. Oh! indeed. Well, they are alike in one respect? Ans.—Yes, sir; they do not know their letters. Do the others in that standard know theirs? Ans.—Yes, sir; all the others do. Very well; then we may say the same of the boys in that class, as we said of the pens and the stones: they are *alike* among themselves, but *unlike* the others. Now look, boys. I have a number of little pieces of paper, on each of which is a word, and also a sentence containing that word. Here is one with the word 'light' on it, and the sentence is, 'Give me a light, Tom.' Here is another: the word is 'rain,' and the sentence, 'It will soon rain.' Have you boys learned any grammar yet? Ans.—Yes, sir; nouns and verbs. (Another boy): We are just beginning adjectives; but we do not know much about them yet. Very well; now each of these slips of paper has either a noun or a verb or an adjective on it, as well as a sentence with the word in it. I want to put each kind of word by itself; what did we call this? Ans.—Classifying. Before we begin, perhaps some boy can tell me why I put the *sentence* as well as the *word* on the slip? Ans.—Because you can't tell what part of speech the word is until you see it in a sentence. That's true, my boy. Can you give me an instance? Ans.—Yes, sir; the word 'board.' Very well; give me a sentence where the word board is a noun? Ans.—This floor is made of boards. Now another sentence where it is not a noun? Ans.—This is a Board school. What is the word there? Ans.—An adjective. (Another boy): It may be a verb—he bored a hole. (Another boy): That's not the same word. Certainly it is not; you are wrong in the word you use. I will write the two on the board. There, notice the difference. Now we will classify all these words. 'Light' in the sentence 'Give me a light, Tom,' what part of speech is it? Ans.—A noun. Yes; we will put it upon this slate: that is the place for all the nouns. (In like manner the whole of the words will be arranged into the three classes, and conclusions as to *likeness* and *unlikeness* drawn.) Suppose, boys, you and I were all to go, some fine afternoon, out into the fields or the park, we should see a great number of different things. Tell me some of them. Ans.—Trees, grass, birds, cows, the pond, stones, hills, boys, flowers, butterflies. Very good, that will do. Now, do you think we could classify all these things? Suppose you had to arrange all these objects so as to put all those together that were alike among themselves, but unlike the rest, how would you set to work? Ans.—We could not do it: they are all so different. Indeed? Are they all different in *every* respect? Are none of them *alike* in some things? Ans.—Yes, sir, some of them are alike; a tree is like the grass. (Another boy): No; a tree is nothing like a bit of grass. (The previous boy): Yes, they both grow out of the ground. (Another boy): So does a bird grow. (Another boy): But a bird does not grow out of the ground. (Another boy): A cow is like a sheep—they both eat. Trees don't eat. (Another boy): Please, sir, my father says if flowers don't have food they die; so they do eat. Now, stop a minute, boys. Let us take a sheep and a tree. Is there not any respect in which they are alike? Answers.—They both get bigger. They both want food. Both live. You can have a dead sheep and a dead tree. Very well; then we will say that all the trees, the grass, the flowers, the sheep, the butterflies, and, in fact, all vegetables and animals live, take food and grow, and sooner or later they die; so you see they are all alike in these respects. We will call them 'living things.' I want you to tell me whether they are different in these respects from any of the other things you may see in the fields? Ans.—Yes, sir; they are different from the stones. From anything else? Ans.—The pond. Anything else? Ans.—The iron gate, the clouds, the hills. Can you tell me in what particular respect all the things you have mentioned are *unlike* vegetables and animals? Ans.—They don't eat. Ah! this boy is always thinking about whether things *eat* or not. Let us have some other point of difference? Ans.—They do not live. Yes, that is better. We will say they are *lifeless*. Now, into how many classes have we divided all the objects we find in the fields? Ans.—Things that live and things that do not live. Very well; suppose I write on the board: 'Things in the field are either—1st, living things, or 2nd, lifeless things.' Now if I were to tell you that a certain object was in class 2, what would you know about it? Ans.—We should know it was without life. And if I were to tell you that another object was in class 1, what would you then know? Ans.—That it *had* life. Can any of you tell me whether there is any particular *use* in classifying things? Ans.—We know something about them. Well, but I suppose you would know *something* about them even if you did not classify them? (A boy holding up his hand.) Well? Ans.—We couldn't classify them until we *did* know something about them. Ardy, just explain what you mean. Ans. (Ardy).—We must know what things live and what things do *not* live before we can make up those two classes. Just so, Ardy; so that classification does not *teach* us anything fresh about things: it only *shows* us what has already been found out. Suppose I write on the board: 'Classification shows us that a group of objects are alike among themselves in some things, but they are different from other objects.' End of lesson.

(To be continued.)

ANSWERS TO
Pupil Teachers' Examination Papers.

JULY 28.

FIRST YEAR.

Pupil Teachers at end of First Year.

Arithmetic.

Three hours and a half allowed.

MALES.

1. Find the value of $3\frac{1}{4}$ of $2\frac{1}{10} - 4\frac{2}{3} \div 4\frac{2}{1\frac{1}{2}}$.

$3\frac{1}{4}$ of $2\frac{1}{10} - \frac{4\frac{2}{3}}{2\frac{2}{3}} \div \frac{4\frac{2}{3}}{1\frac{1}{2}} = \frac{13}{4}$ of $\frac{21}{10} - \frac{\frac{14}{3}}{\frac{8}{3}} \div \frac{\frac{14}{3}}{\frac{3}{2}}$

$$= \frac{15\times21}{4\times10} - \frac{35\times7}{8\times20} \div \frac{14\times8}{3\times15}$$
$$= \frac{9}{8} - \frac{35\times7\times3\times15}{8\times20\times14\times8}$$
$$= 7\tfrac{1}{8} - \tfrac{11}{16}$$
$$= 7\frac{448-315}{512} = \underline{7\tfrac{133}{512}}. \quad \text{Ans.}$$

2. Reduce to vulgar fractions in their lowest terms, ·00045, ·083, ·26136, ·3142857.

(*a*) ·00045 = $\frac{45}{100000}$ = $\underline{\frac{9}{20000}}$ Ans.
(*b*) ·083 = $\frac{83}{1000}$ = $\underline{\frac{83}{1000}}$ Ans.
(*c*) ·26136 = $\frac{26136}{100000}$ = $\underline{\frac{3267}{12500}}$ Ans.
(*d*) ·3142857 = $\frac{3142857}{10000000}$ = $\underline{\frac{11}{35}}$ Ans.

3. Find the exact value in money of ·04375 of £2 10s. – ·0625 of 10s. 6d. – ·16 of 2d.; and reduce the result to the decimal of 10s.

(*a*)

		s.		s.	d.
·04375 of 50s.	=	2·1875	=	2	2½
– ·0625 of 10·5s.	=	·65625	=		7⅞
Diff.	=	1·53125	=	1	6⅜
– ·16 of 2d. or $\frac{4}{25}$s.	=	·027777	=		⅓
Diff.	=	1·503472s.	=	1	6$\frac{1}{18}$ exact value.
		12			
		6·04166d.			

(*b*) 1·503472s. reduced to dec. of 10s. = $\underline{\cdot1503472}$. Ans.

4. A owns $\frac{7}{16}$ of a ship and B $\frac{9}{24}$ of it. A sells $\frac{3}{8}$ of his share to B, whose share is then worth £1300 more than A's. Find the value of the ship.

(1) After selling $\frac{3}{8}$ of $\frac{7}{16}$, A has $\frac{7}{16} - \frac{3}{40}$, or $\frac{29}{80}$ remaining.

(2) After getting $\frac{3}{8}$ of $\frac{7}{16}$ or $\frac{21}{80}$ B has $\frac{9}{24} + \frac{21}{80}$, or $\frac{25+24}{320} = \frac{49}{320}$.

(3)

Excess of B's share over A's $= \frac{49}{320} - \frac{29}{80} = \frac{49-36}{320} = \frac{13}{320}$ of the ship,

which excess is valued at £1300.

∴ 13 : 320 :: £1300 : value of ship.

$$\frac{£1300\times320}{13} = \underline{£32{,}000}. \quad \text{Ans.}$$

FEMALES.

1. Make out the following bill:—5 parcels of tea, each 15½ lbs., at 2s. 7d. per lb.; 1 chest of tea, weighing 2 qr., at 2s. 6d. per lb.; 10 cwt. 2 qr. of sugar at 4d. per lb.; 1 barrel of treacle, weighing 2 cwt., 1½d. per lb.; 24 boxes of raisins at £1 5s. 6d. per box; 3 cwt. 2 qr. of rice at 1d. per lb.; 3 boxes of soap, each 2 cwt. 1 qr., at £1 10s. 6d. per cwt.; 3 hams, each 14 lbs., at 9½d. per lb.; 2 boxes of oranges, each containing 500, at 4s. 6d. per 120.

			s.	d.		£	s.	d.
5 parcels, each 15½ lbs.	(77½ lbs.) at	2	7	per lb.	=	10	0	2½
2 qr.	(56 ,,) ,,	2	6	,,	=	7	0	0
10 cwt. 2 qr.	(1176 ,,) ,,	0	4	,,	=	19	12	0
2 cwt.	(224 ,,) ,,	0	1½	,,	=	1	8	0
24 boxes	,,	25	6	each	=	30	12	0
3 cwt. 2 qr.	(392 ,,) ,,	0	1	per lb.	=	1	12	8
3 boxes, ea. 2 cwt. 1 qr.	(6½ cwt.) ,,	30	6	,, cwt.	=	10	5	10½
3 hams, ea. 14 lb.	(42 lbs.) ,,	0	9½	,, lb.	=	1	13	3
2 boxes oranges, 500 in box	,,	4	6	,, 120	=	1	17	6
						84	1	6

2. Find the value of 4013 articles at £12 7s. 0½d. each.

				£	s.	d.
Price of 4013 arts. at £1 each			=	4013	0	0
						12
,, ,,	£12	,,	=	48156	0	0.
,, ,,	4s.	,,	= ⅓ of £1 =	802	12	0
,, ,,	2s.	,,	= ½ ,, 4s. =	401	6	0
,, ,,	1s.	,,	= ½ ,, 2s. =	200	13	0
,, ,,	½d.	,,	= 1/24 ,, 1s. =	8	7	2½
				49568	18	2½

3. $20\frac{3}{4} + 11\frac{7}{11} + 10\frac{11}{12} + 9\frac{11}{20}$.

$$20\tfrac{3}{4} + 11\tfrac{7}{11} + 10\tfrac{11}{12} + 9\tfrac{11}{20} = 50\,\frac{825+840+968+1260}{1320}$$
$$= 50\tfrac{3893}{1320} = \underline{52\tfrac{1133}{1320}}. \quad \text{Ans.}$$

4. Reduce to Lowest Common Denominator ⅛, 11/12, 9/10, 7/16, 23/40.

$$\tfrac{1}{8}, \tfrac{11}{12}, \tfrac{9}{10}, \tfrac{7}{16}, \tfrac{23}{40} = \frac{20, 55, 144, 70, 92}{160} \quad \text{Ans.}$$

L. C. M. of denrs. = 160.

Grammar.

1. '*There flow'ry* hill *Hymettus*, with the *sound*
Of *bees*' industrious *murmur*, oft *invites*
To studious *musing*.'

Analyse this sentence, parsing the words in Italics.

2. Point out any endings of words in the above which are of purely English origin.

(1) There.....*adverb* (*place*) *extending predicate* (6).
(2) flow'ry hill .....*enlargement of subject* (3).
(3) Hymettus .....*simple subject.*
(4) with the sound of bees' industrious murmur .....{ *adv. phrase* (*manner*) *extending predicate*(6).
(5) oft .....*adv.* (*time*).
(6) invites .....*simple predicate.*
(7) to studious musing .....*prep. phrase completing the predicate* (6).

PARSING.

There—adv. place, mod. 'invites.'
flow'ry—adj., qual. 'hill Hymettus.'
sound—abstr. noun, neut., sing., obj. gov. by 'with.'
bees'—com. noun., masc. or fem., plur., poss. attrib. to 'murmur.'
murmur—abstr. noun, neut., sing., obj. gov. by 'of.'
invites—reg. intrans. verb (generally trans.), indic., pres. indef., 3rd pers., sing., agr. with subj. 'Hymettus.'
musing—abstr. noun, neut., sing., obj. gov. by 'to.'

2. The endings purely English are: -y in flow'ry, -s in invites, and -ing in musing; also the ' (apostrophe) in bees' to distinguish the possessive case from the plural number of the noun—in writing.

3. Mention, with examples, some of the common terminations of *English* nouns and adjectives.

Terminations of nouns:—

-er (-ar -or); as baker, doer, sailor, beggar.
-dom; as wisdom, kingdom.
-hood, -head; godhead, manhood.
-ness; goodness, kindness.
-ship; friendship, lordship.
-th; health, wealth, strength.

Terminations of adjectives:—

-en, -ed, -ful, -ish, -ly, -like, -less, -some, -y, -ward, -teen, -fold, -ern; as golden, wretched, thankful, blackish, goodly, godlike, shameless, toothsome woody, wayward, seventeen, fourfold, eastern.

Geography.

(*Answer either Question* 2 *or Question* 3, *not both.*)

1. Describe clearly the positions of the mountain and hill ranges of Scotland, and their connection with each other.

Scotland consists of two masses of mountains, each of which stretches across the country from sea to sea, and of a narrow plain that lies between them. The mountain masses strike across the land from west to east, but they differ widely in extent from one another, and from the valley which they enclose. The two great divisions into which the mountains of Scotland group themselves are Highlands and Lowlands. The most important feature in the geography of the Highlands is the irregular disposition of their mountain masses. They never unite in distinct ranges, though they form short ridges and walls of rock. They occupy the whole of northern Scotland, their southern boundary being indicated by a line drawn across Scotland from the Mull of Cantyre to Girdleness, near Aberdeen. It is a common practice to describe a part of this vast and irregular mass of heights under the name of the Grampian Mountains. Among these irregular masses, however, a watershed is found traversing the whole of the Highland district from Cape Wrath to Loch Lomond, and

this high ground parts the rivers which fall into the Atlantic from those that fall into the North Sea. The main range sends off two great side branches, one of which divides and encloses Banffshire, and the other goes south to the isthmus of Cowal, in Argyll. Ochil and Sidlaw range parallel with the Grampians, and separated from them by the valley of Strathmore, consists of three small chains which extend across the country from Forfarshire to Stirlingshire, and form the north water-parting of the Tay, Forth, and Clyde basins. The Lammermoor and Pentland range, separated from the former by the Frith of Forth, and forming the southern boundary of the Forth basin, consists of the following parts:—The Lammermoor Hills between Haddington and Berwick; the Moorfoot Hills; the Pentland Hills in Midlothian, and Tinto Hill in Lanarkshire.

The Cheviot and Lowther range extends from Peel Fell on the Borders to Loch Ryan in Wigtownshire, and forms the great water-parting of the south of Scotland, separating the basins of the Solway and Tyne on the south from those of the Clyde and Tweed on the north.

2. Describe fully the settlement of Manitoba, and the rivers which flow through it.

Manitoba, formerly known as the Red River Settlement, is situated on the banks of the Red River, and is a province of the Dominion of Canada. The population is composed of native Indians and half-breeds, emigrants from Scotland and Canada, and retired servants of the Hudson Bay Company. The soil is very fertile, and large grain crops are raised. The settlers possess great numbers of cattle and sheep. The rivers freeze in November and open in April, but Lake Winnipeg remains frozen till May. The province was almost forcibly annexed to the Dominion, 1870. The capital is Winnipeg City, situated at the fork of the Red and Assiniboine Rivers. The Red River, rising in Minnesota (U.S.) and flowing north, divides Dakota from Minnesota, and forms an important tributary to Lake Winnipeg, which it enters on the south. Before falling into the lake it is joined on its left bank by a much more important stream, the Assiniboine, which with its tributaries drains an immense area.

3. Explain clearly why so little is known about the interior of Australia, and why no British settlements have sprung up except near the coast.

Draw a map in illustration of *one* answer. Insert the lines of latitude and longitude.

On account of the danger and difficulty in exploring the interior, very little is known of Australia beyond the fertile margin containing the settlements, and which lies on the coast. The results of explorations made in recent years have, however, dissipated many delusions which once prevailed on the subject, and which prejudiced settlers against even attempting to proceed beyond the customary limit. Instead of the country being an arid desert, as was supposed, in nearly every direction in which the interior has been traversed watered and grassy plains have been discovered. Exceptional tracts undoubtedly occur, and except in the north, the whole island suffers more or less from occasional droughts. It is only in the extreme centre that the term 'desert' can properly be applied. One chief characteristic of the interior is its flatness, and the moderate elevation of even its highest grounds. After excessive rains some of the plains are converted into shallow seas.

The mountain ranges, as has been said, are all near the coast, and this fact, combined with the general impassable nature of these chains and the uninviting nature of the interior, caused the settlements to be founded along the sea-board, where there are streams and general fertility.

History.

1. What was the great object of the Romans in making roads? Give the name and route of any roads made by them in Britain.

The great object of the Romans in making roads seems to have been the connecting of cities in which the conquered population was grouped. They served as expeditious means of developing the resources of the island.

Four great roads crossed the country: *Watling Street* from Rutupiæ (Richborough) past London to Carnarvon; *Ikenild Street* from Tynemouth by York to St. David's; *Irmin Street* from St. David's to Southampton; and *the Fosse* from Cornwall hrough Exeter to Lincoln.

2. In the Saxon tribes how was the king chosen, and what were his duties

The kingly office among the Saxons was elective: the nation, by its chiefs in the great national council, chose the best qualified amongst the nearest male relatives of the late monarch, preference being given to the eldest son, if not unfit.

The king in these times was not looked upon as lord of the soil, but as leader of the people, his principal duty being to lead them in battle. He was bound to observe the laws and customs of the people, and was guided by a council called the Witena-gemót. This council and the king made laws and treaties, and appointed or removed the officers of state.

3. Who was Harold II.? Tell how he gained the throne, and how he lost it.

Harold II. was the son of Earl Godwin, a powerful Saxon noble, by whose influence Edward the Confessor gained the throne. On the death of Edward, the Witena-gemót elected Harold to the vacant throne; but Duke William of Normandy instantly demanded possession of the kingdom, partly on the ground that Harold had sworn to support him. Harold repudiated the oath, and asserted the legality of his right as conferred by the Witena-gemót. William invaded England with 60,000 men and defeated Harold at Hastings, 1066. By the death of Harold, towards the close of the battle, William was left in possession of the English crown.

Composition.

Write from memory the substance of the passage read to you by the inspector.

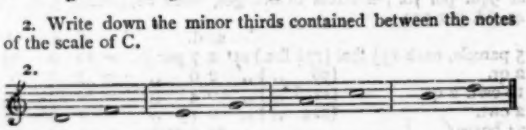
In Siberia, as one gets north, one finds at the stations fine dogs kept on purpose for sledging. A Russian traveller will hire a sledge with a team of six dogs, travel in it ten or fifteen miles to the next station, where he gives the dogs a feed, and then send the sagacious creatures home again with the empty sledge. The dogs are a little like a Scotch sheep-dog, but with very bushy hair. They have sharp noses, short, straight ears, and a bushy tail curled over the back. Some are black, some white, but the handsomest-coloured are of a grey fawn-colour.

Music.

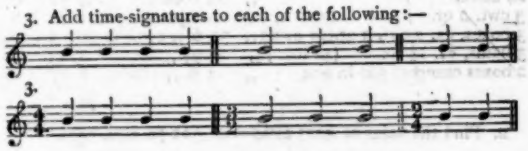
A quarter of an hour allowed for this paper.

1. Write above each of the following notes its value-name (semibreve, &c.); and write below each its pitch-name (C, D, E, &c.):—

2. Write down the minor thirds contained between the notes of the scale of C.



3. Add time-signatures to each of the following:—



TONIC SOL-FA NOTATION.

1. Write a six-pulse tone, using three-pulse measure.

1. |1 :— :— |— :— :— ‖

2. Write down the minor thirds contained between the notes of the common scale.

2. *Ray* to *fah*; *me* to *soh*; *lah* to *doh*^{1}; *te* to *ray*^{1}.

3. Write the following an octave lower, and state what is meant by the direction as to key:—

KEY D.

|d^1 :s |m :l |s :t |l :t |d^1 :— ‖

3. KEY D.

$|d \;:s_1 \;|r_1 \;:l_1 \;|s_1 \;:t_1 \;|l_1 \;:t_1 \;|d \;:— \;\|$

Since a common scale may be founded on any tone of absolute pitch, it is said to be in the key of that tone which it takes for *doh*; thus, Key D directs that after sounding the pitch of C on a tuning-fork, the singer is to run down to D (*ray*) the pitch-tone required for *doh*.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed for this Paper.

FIRST PAPER.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including number 3 *if possible.*

1. The angles at the base of an isosceles triangle are equal to each other; and if the equal sides be produced, the angles on the other side of the base shall be equal. Prop. 5, Bk. I.

2. If at a point in a straight line, two other straight lines, upon the opposite sides of it, make the adjacent angles together equal to two right angles; then these two straight lines shall be in one and the same straight line. Prop. 14, Bk. I.

3. How many triangles having two sides five feet and six feet long can be formed so that the third side shall contain a whole number of feet?

Since the length of the third side must always be less than eleven feet (I. 20 and 22), therefore *ten* triangles can be constructed, whose third side shall contain a whole number of feet, namely, 1 foot, 2, 3, 4, 5, etc., or 10 feet.

Arithmetic.

FEMALES.

1. Find the value of—

$$2\tfrac{2}{3} \text{ of } \tfrac{7}{9} + \tfrac{4}{9} \text{ of } 3\tfrac{5}{11} \text{ of } 1\tfrac{5}{13} - \tfrac{9}{11} \text{ of } 1\tfrac{4}{9} \text{ of } 2\tfrac{1}{5}.$$

$$2\tfrac{2}{3} \text{ of } \tfrac{7}{9} + \tfrac{4}{7} \text{ of } 3\tfrac{5}{11} \text{ of } 1\tfrac{5}{13} - \tfrac{9}{11} \text{ of } 1\tfrac{4}{9} \text{ of } 2\tfrac{1}{5} =$$

$$\frac{12\times7}{5\times9} + \frac{5\times35\times17}{7\times11\times15} - \frac{6\times13\times14}{11\times9\times5} =$$

$$\tfrac{28}{15} + \tfrac{68}{33} - \tfrac{364}{165} = \frac{308+425-364}{165} = \tfrac{369}{165} = \underline{2\tfrac{39}{165}}. \text{ Ans.}$$

2. Add together the quotients of $3\frac{1}{9}$ by $1\frac{5}{12}$ and $1\frac{5}{12}$ by $3\frac{1}{9}$.

$$(3\tfrac{1}{9} \div 1\tfrac{5}{12}) + (1\tfrac{5}{12} \div 3\tfrac{1}{9}) = (\tfrac{28}{9} \div \tfrac{17}{12}) + (\tfrac{17}{12} \div \tfrac{28}{9})$$

$$= \frac{34\times12}{9\times17} + \frac{17\times9}{12\times34}$$

$$= \tfrac{8}{3} + \tfrac{3}{8} = \frac{64+9}{24} = \underline{3\tfrac{1}{24}}. \text{ Ans.}$$

3. Three persons having $£4\frac{7}{12}$, $£5\frac{5}{12}$, and $£2\frac{1}{8}$, subscribe respectively, $\frac{5}{11}$, $\frac{5}{13}$, and $\frac{1}{8}$ of their money. What is the total subscription?

$$\tfrac{5}{11} \text{ of } £4\tfrac{7}{12} = £\tfrac{53}{12} \times \tfrac{5}{11} = £\tfrac{5}{12} = £\tfrac{10}{24}$$

$$\tfrac{5}{13} \text{ of } £5\tfrac{5}{12} = £\tfrac{65}{12} \times \tfrac{5}{13} = £\tfrac{25}{12} = £\tfrac{50}{24}$$

$$\tfrac{1}{8} \text{ of } £2\tfrac{1}{8} = £\tfrac{17}{8} \times \tfrac{1}{8} = £\tfrac{17}{64} = £\tfrac{17}{64}$$

$$\tfrac{77}{64} = \underline{£2}. \text{ Ans.}$$

4. A man cuts off $\frac{7}{10}$ of a plank, and then $\frac{5}{16}$ of the remainder; what fraction of the whole will be left?

After cutting off $\frac{7}{10}$ there remains $\frac{3}{10}$

$$\tfrac{5}{16} \text{ of } \tfrac{3}{10} = \tfrac{3}{32}; \quad \tfrac{3}{10} - \tfrac{3}{32} = \frac{14-9}{20} = \underline{\tfrac{1}{4}}. \text{ Ans.}$$

5. Reduce to decimals $2\frac{3}{40}$, $4\frac{13}{800}$, $5\frac{9}{1000}$.

$2\frac{3}{40} = \underline{2{\cdot}075}$. Ans.

$4\frac{13}{800} = \underline{4{\cdot}01375}$. Ans.

$5\frac{9}{1000} = \underline{5{\cdot}00009375}$. Ans.

Grammar.

1. *Yet once more, O* ye *Laurels and* once more
Ye Myrtles brown, with Ivy never *sere*,
I come to pluck your berries harsh and *crude*,
And with *forced* fingers *rude*
Shatter your leaves *before* the *mellowing year*.

Analyse the foregoing sentence, parsing the words in italics.

I	*subject.*
come	*predicate.*
to pluck your berries harsh and crude, and with forced fingers rude (to) shatter your leaves before the mellowing year	*completion of the predicate.*
yet once more, (and once more)	*extensions of predicate (time).*
O ye Laurels, ye Myrtles brown, with Ivy never sere	*explanatory phrases having no grammatical connection with the sentence, but explanatory of 'your.'*

PARSING.

yet—adverb mod. 'once more.'
once— ,, 'come.'
more— ,, 'come.'
O—interjection.
Laurels—com. noun, personified, nom. of address, or vocative.
and—co-ord. conj. connecting Laurels and Myrtles (or the two phrases 'once more, O ye Laurels,' and 'once more, ye Myrtles brown.')
sere—predic. adj. qual. 'Ivy.'
crude— ,, ,, 'berries.'
forced—part. adj. qual. 'fingers.'
rude—predic. ,, ,, ,,
shatter—reg. trans. verb, infin., pres. indef., gov. by 'come.'
before—prep. gov. obj., case 'year.'
mellowing—verbal adj. qual. 'year.'
year—abstr. noun, neut., obj. gov. by 'before.'

2. Give the meaning of the following Latin prefixes, and instance words compounded of them:—ad, cum, ex, præ, per, sine, vice.

	Meaning.	Examples.
ad	to, at,	adhere, accept, affix, allege, appear, arrive, assent, attend.
cum	with	compel, commit, correct, collect, co-here.
ex	out of, from	expel, elect, efface, ex-mayor.
præ	before	precede, presume, predict.
per	through	perceive, perform, pellucid, pursue.
sine	without	sincere, sinecure.
vice	instead of	vicar, viceroy, vice-chancellor, viscount.

3. Mention some terminations of *Adjectives* derived from the Latin.

The following terminations are from the Latin:— -al, -an, -ar, -ary, -ine, -ile, -able, -ic, -ous, -ive; as legal, pagan, regular, necessary, feminine, puerile, capable, prolific, amorous, positive.

4. Paraphrase this passage:—

Tired Nature's sweet restorer, balmy Sleep!
He, like the world, his ready visit pays
When Fortune smiles: the wretched he forsakes,
Swift on his downy pinions flies from woe,
And lights on lids unsullied by a tear!—YOUNG.

That comforting sleep which refreshes our wearied minds and bodies may be compared to the flatterers who attend those endowed with all the blessings of life, for it flees from us when our minds are in distress, and goes to those who are free from every care.

Geography.

1. Describe as fully as you can, the different routes by which a traveller may go from Lucerne to Milan, and the most striking physical features of the country he would pass through by each route.

Leaving the town and sailing down the Lake of Lucerne a traveller would pass Altorf, and thence strike along the Alpine road, called the Pass of St. Gothard, which leads to Lake Maggiore and Milan. His way lies along a good diligence road to Andermatt, and thence to the Hospice for travellers on the top of the pass, the ridge through which the road winds being from 8,000 to 11,000 feet high. The pass ends at Bellinzona on the Italian side, which contrasts very strikingly with the Swiss scenery enjoyed from Lucerne. The country, called the Plain of Lombardy, south of the Alps, is flat, and a canal connects the Ticino with Milan.

The traveller might go by rail from Lucerne, and pass through the famous St. Gothard Tunnel, nine and a half miles long, having its north end at Göschenen and its south end at Airolo. Thence the line goes to Milan viâ Bellinzona and the picturesque lakes, Lugano and Como.

The traveller might vary his route by crossing from Uri or Berne, by the Furka or Grimsel Passes, into Valais; travelling down the valley of the Rhone, and afterwards crossing by the Simplon Pass, or proceeding further on to Martigny and crossing by the St. Bernard Pass to Aosta.

By proceeding to Chur, he could reach Bellinzona by the Bernhardin Pass, the great commercial highway from Italy to Switzerland and Germany.

2. Explain this statement:—

'*Nearly the whole of Hindostan lies between the 10th and the 30th parallels of North Latitude, and between the 70th and the 90th meridians of East Longitude.*'

On the terrestrial globe there are lines drawn up and down as well as across for the purpose of fixing places, for without these lines the places could not be fixed. The lines running from the North Pole to South Pole are called meridians of longitude, usually given as thirty-six, dividing the globe into thirty-six equal parts, each of which again is divided into ten degrees, or 360 degrees in all. The lines which run round the globe from west to east at right angles to the meridians of longitude are called parallels of latitude, and of these there are seventeen shown. The middle one goes round the world at its largest part, and is called the Equator, and there are eight to the north and eight to the south of it, dividing the space between the Equator and each Pole into nine parts and these also are each of ten degrees. They are numbered from one to ninety upwards and from one to ninety downwards; those above the Equator being called parallels of north latitude, those below it parallels of south latitude.

Now since longitude in this country is reckoned from the first meridian passing through Greenwich, and since latitude is reckoned from the Equator as explained above, the statement gives us a clear idea not only how far Hindostan is from London, and how far from the Equator which indicates the middle of the Torrid Zone; but we can calculate the size of the country by reckoning sixty-nine miles for every degree.

3. What parts of British India are beyond these limits? And what o'clock would it be at each limit of Longitude when it was 12 o'clock at Greenwich?

South of the 10th parallel lie Ceylon and a small point of the Peninsula; north of the 30th parallel lies the Punjaub. West of the 70th meridian are Scinde and a small part of the Punjaub, and to the east of the 90th meridian is Assam.

As the earth goes round on its axis once in every 24 hours, its surface moves at the rate of 15 degrees an hour, for it was explained that the circumference of the earth is divided into 360 degrees, and $15 \times 24 = 360$. Therefore we must reckon 4 minutes for every degree of longitude. If the place is east of London the people there have the sun earlier, or when it is noon at Greenwich at the 90th meridian it will be 4 min. $\times 90 =$ 360 min., or 6 hours, *i.e.*, 6 o'clock p.m. At midnight London time it will be 6 a.m. at the 90th meridian.

At the 70th limit the difference will be 4 min. $\times 70 = 280$ min., or 4 h. 40 min., that is, 4.40 p.m. when it is noon, and 4.40 a.m. when it is midnight in London.

4. Where are Zaragoza, Toulouse, Liège, Frankfort, Poonah, Hydrabad, Lahore, and Simla? Describe fully the situation of two of them, and mention any historical events connected with them.

Draw a map in illustration of *one* answer. Insert the lines of latitude and longitude.

Zaragoza (Saragossa), a city of Spain on the Ebro, was an important place under the Romans, and is celebrated for its heroic resistance against the French, 1809.

Toulouse, a city of France on the Garonne, is noted as the place where was fought the last battle of the Peninsular war, when Wellington defeated Soult, 1814.

Liège, a town of Belgium, on the Maas, is situated in a pleasant valley, and has extensive iron-works, on which account it is called the 'Birmingham of Belgium.'

Frankfort, a town of Germany, on the Main, is well-built, and is the chief emporium of the inland trade of the empire. It was formerly one of the free towns, forming the Hanseatic League.

Poonah, in the Presidency of Bombay, was the capital of the Mahratta Empire till 1818, when it was incorporated with British India. It is situated in a treeless plain, 2000 ft. above the sea.

Hydrabad, capital of Scinde, near the Indus, is a strong fortress. Another city of the same name is the capital of the Nizam's Dominions, in a barren district, and has a mosque of some fame as being on the model of the Kaaba at Mecca.

Lahore, the capital of the Punjaub, near the Ravee, stands on the great road from Delhi to Cabool. It has some magnificent structures.

Simla is a mountainous district of the Punjaub between the Sutlej and the Jumna. It has a station from 7000 to 9000 ft. above the sea, as a resort for invalids of the British Army. The surrounding scenery is splendid, but the town is built on sites scooped out of the hill-sides for want of level ground on which they can be built.

SECOND PAPER.

Two hours and a half allowed.

Arithmetic.

MALES.

1. A lends to B £4213 6s. 8d. on interest, and at the end of 8 months the capital and interest amount to £4339 14s. 8d. Find the rate of interest per cent. per annum.

Interest = £4339 14s. 8d. − £4213 6s. 8d. = £126 8s.

£4213⅓ : £100
8 mos. : 12 mos. } :: £126⅔ : rate

$$£126\tfrac{2}{3} \times \frac{100}{4213\tfrac{1}{3}} \times \tfrac{12}{8} = £\tfrac{380}{3} \times \tfrac{100}{12640} \times \tfrac{12}{8}$$

$$= £\tfrac{3}{8} = \underline{4\tfrac{1}{2} \text{ p.c.}} \text{ Ans.}$$

2. In a mixed school 20 per cent. of the scholars are infants under 7, and the number of girls above 7 is ⅜ the number of boys above 7, and amounts to 64. Find the number of scholars in the school.

(*a*) 20 p.c. = $\frac{20}{100}$ or $\frac{1}{5}$ ∴ $\frac{4}{5}$ is the fraction of boys and girls.
(*b*) 64 = ⅜ the number of boys ∴ boys = $64 \times \frac{8}{3} = 96$
(*c*) 96 + 64 = 160, no. of boys and girls.
(*d*) 160 is $\frac{4}{5}$ of the scholars ∴ total = $160 \times \frac{5}{4} = \underline{200}$. Ans.

3. How much money must I invest in 4½ per cent. railway stock at 137½ to get an income of £108, brokerage being ¼ per cent.?

It requires an investment of £137½ + ¼ to get an income of £4½

∴ 4½ : 108 :: £137¼ : ?

$$£137\tfrac{1}{4} \times \frac{108}{4\tfrac{1}{2}} = £\tfrac{549}{4} \times \tfrac{216}{9}$$

$$= \underline{£3300}. \text{ Ans.}$$

4. A man earns 25s. a week, and spends 15s. 6d. on food, 3s. 6d. on lodgings, and 2s. 6d. on clothes. What percentage of his earnings does he spend on each of these three things?

Fraction of earnings spent — p.c.

on food = $\frac{15\frac{1}{2}\text{s.}}{25} = \frac{31}{50}$ and $\frac{1}{50}$ of 100 = $\underline{62}$. Ans.

,, lodgings = $\frac{3\frac{1}{2}}{25} = \frac{7}{50}$,, $\frac{1}{50}$,, = $\underline{14}$. Ans.

,, clothes = $\frac{2\frac{1}{2}}{25} = \frac{5}{50}$,, $\frac{1}{50}$,, = $\underline{10}$. Ans.

History.

1. Name the children of William I., and describe any disputes between them for the possession of lands.

The children of William I. were Robert, Richard, William, Henry, and Adela.

William (Rufus) usurped the throne, which should have fallen to Robert, and not content with this he aimed at Robert's duchy of Normandy. By treachery he almost accomplished his desires, but peace was made between the brothers by the intervention of the Norman barons and the French king. Subsequently Robert, in order to join the Crusaders, parted with Normandy to William for five years on receipt of 10,000 merks.

On the death of Rufus during Robert's absence in Palestine, Henry, the youngest son, took possession of the kingdom, and managed to persuade Robert to accept a yearly pension in place of the throne. Robert was afterwards forced to resign this allowance as ransom to Henry, and disputes leading to war Robert was taken prisoner, and after thirty years' confinement died in Cardiff Castle.

2. In what periods do we read of Anselm and Becket? For what were they distinguished?

We read of Anselm in the reign of William Rufus, (1087-1100). This king brought him to England and forced him to accept the Archbishopric of Canterbury. He was finally banished from England for bravely opposing the tyrannical oppressions of William.

Becket was Archbishop of Canterbury in the reign of Henry II. (1154-1189). He is distinguished for a dispute with the king respecting the privileges of the Church. A priest having committed a crime the king insisted that he should be tried before the civil judge, but Becket declared that this was contrary to the laws of the Church. The king enraged called a council of nobility and clergy to settle the matter of dispute. They met at Clarendon in Wilts and made several regulations called the 'Constitutions of Clarendon,' providing that clergymen should be tried in the civil courts, and that a layman should not be punished by the clergy before being legally tried. Becket at first assented to this, but afterwards went to the palace and protested. This led to a quarrel between him and the king, and the breach ended in Becket's murder, 1174.

3. Who was Edward I.? What efforts did he make to extend his power in this island?

Edward I. was the eldest son of Henry III., and succeeded him 1272. After his coronation he tried to extend his power in this island by making war on Wales and Scotland. He entirely subdued Wales by the defeat and death of its prince Llewellyn. He reconciled the Welsh to this subjugation by making his son Prince of Wales; and ever since the eldest son of our sovereigns has inherited the title.

Although he conquered the Scots in three battles he was unable to subdue them, for no sooner had he returned to England than they rose in arms to recover their independence. Indeed, it was while preparing to attack the Scots with a large army that he died near Carlisle, 1307.

Teaching.

Mention any monosyllables which present special difficulties in spelling to young learners, and say how you would deal with such words.

Monosyllables that present difficulties are those which contain (1) silent letters, such as, 'gnat,' 'gnaw,' 'knit,' 'know,' 'calf,' 'half,' 'lamb,' 'thumb,' 'bough,' etc., (2) unusual combinations; as, plough, tough, through, view, ewe, field, siege, etc., (3) words sounded alike but spelt differently, as, their, there; here, hear; cite, site, etc.

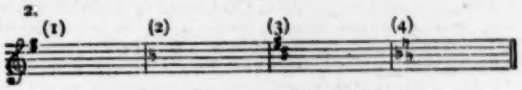
The best way of dealing with these is to make lists on the blackboard, practise the pupils in reading them and spelling them orally, copying them on slates or entering in note-books. As regards (3) the best plan is to compose simple sentences, introducing the words and pointing out their uses.

Music.

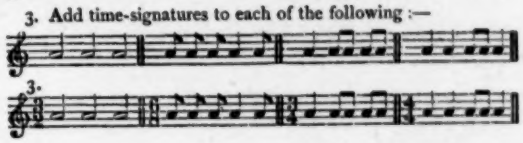
A quarter of an hour allowed for this paper.

1. Write below each of the following intervals its name (minor third, &c.):—

2. Write the key-signature of each of the following major keys: (1) G. (2) F. (3) D. (4) E flat.



3. Add time-signatures to each of the following:—



TONIC SOL-FA NOTATION.

1. What is the interval (major third, &c.) (*a*) between *soh* and *te*, (*b*) between *te* and *ray*^{1}, (*c*) between *fah* and *soh*, (*d*) between *doh* and *fah*?

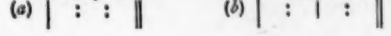
1. (*a*) Major third, (*b*) Minor third, (*c*) Major second, (*d*) Perfect fourth.

2. Which tones of the scale have the strongest leaning tendency?

2. *Ray*, *fah*, *lah*, and *te*.

3. Write (*a*) a three-pulse measure, (*b*) a four-pulse measure.

3. (*a*) Primary form. (*b*) Primary form.



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

FIRST PAPER.

Three hours and a half allowed.

Euclid.

Answer two questions, including Question 3, *if possible.*

[All generally understood abbreviations for *words* may be used.]

1. If a straight line falling on two other straight lines, make the alternate angles equal to each other, these two straight lines shall be parallel.

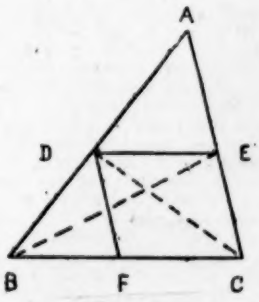
Prop. 27, Bk. I.

2. Triangles upon equal bases and between the same parallels, are equal to one another.

Prop. 38, Bk. I.

3. The straight line which joins the middle points of two sides of a triangle is equal to half the base.

Let the sides AB, AC of the triangle ABC be bisected respectively in D and E; join DE; then DE shall be equal to half the base.



Join BE, DC.

Because AD=DB and the triangles ADE, BDE have the common vertex E (that is, are between the same parallels) then the triangle ADE=the triangle BDE.

For the same reason the triangle ADE=the triangle CDE, and ∴ the triangle BDE=the triangle CED.

But the equal triangles BDE, CDE being upon the same base DE, must be between the same parallels. ∴ DE is parallel to BC.

In the same manner it may be shown that if BC be bisected in F, DF is parallel to AC.

Now since DE is parallel to FC and DF to EC, DFEC is a parallelogram, and DE=FC, that is, half the base.

Q. E. D.

Algebra.

Answer two questions.

1. Show that

$$(3a+2b)^4-(2a+3b)^4=65\,(a+b)\,(a-b)\left\{(a+b)^2-\frac{2ab}{13}\right\}$$

(1) $(3a+2b)^4=81a^4+216a^3b+108a^2b^2+96ab^3+16b^4$

(2) $(2b+3a)^4=16a^4+96a^3b+108a^2b^2+216ab^3+81b^4$

Subtracting (2) from (1) $65a^4+120a^3b-120ab^3-65b^4$ = 1st result.

(3) $65(a+b)(a-b)\left\{(a+b)^2-\frac{2ab}{13}\right\}$

$=65(a^2-b^2)\,(a+b)^2-\frac{2ab}{13}(a^2-b^2)65$

$=65(a^2-b^2)(a^2+2ab+b^2)-10ab(a^2-b^2)$

$=65(a^4+2a^3b-2ab^3-b^4)-10a^3b+10ab^3$

$=65a^4+130a^3b-130ab^3-65b^4-10a^3b+10ab^3$

$=65a^4+120a^3b-120ab^3-65b^4$

= 1st result. Q. E. D.

2. Simplify

$$\frac{(x+y)^2}{x^3-8y^3}-\frac{2}{x-2y}+\frac{x-y}{x^2+2xy+4y^2}$$

L. C. M. of denrs. $=x^3-8y^3=(x-2y)(x^2+2xy+4y^2)$

$$\therefore\frac{(x+y)^2}{x^3-8y^3}-\frac{2}{x-2y}+\frac{x-y}{x^2+2xy+4y}$$

$$=\frac{(x+y)^2-2(x^2+2xy+4y^2)+(x-y)(x-2y)}{x^3-8y^3}$$

$$=\frac{x^2+2xy+y^2-2x^2-4xy-8y^2+x^2-3xy+2y^2}{x^3-8y^3}$$

$$=\frac{-5xy-5y^2}{x^3-8y^3}=\frac{-5y(x+y)}{x^3-8y^3}$$ Ans.

3. Solve the equations :—

(1) $\frac{3x}{2}-\frac{5}{7}=21x-\left(\frac{2x}{3}+31\frac{1}{2}\right)$

(2) $\frac{1}{2}-\frac{7x-1}{6\frac{1}{2}-3x}=\frac{8}{3}\frac{x-\frac{1}{2}}{x-2}$

(1) $\frac{3x}{2}-\frac{5}{7}=21x-\left(\frac{2x}{3}+31\frac{1}{2}\right)$

Clearing of fractions $63x-30=882x-28x-143$

$63x-882x+28x=30-143$

$791x=113$

$x=\frac{113}{791}=\frac{1}{7}$. Ans.

(2) $\frac{1}{2}-\frac{7x-1}{6\frac{1}{2}-3x}=\frac{8}{3}\frac{x-\frac{1}{2}}{x-2}$

Simplifying both sides $\frac{1}{2}-\frac{14x-2}{13-6x}=\frac{8x-4}{3x-6}$

,, left side $\frac{13-6x-42x+6}{39-18x}=\frac{8x-4}{3x-6}$

$\frac{19-48x}{39-18x}=\frac{8x-4}{3x-6}$

clearing of fractions $19x-48x^2-38+96x=104x-52-48x^2+24x$

transposing $19x+96x-104x-24x=48x^2-48x^2+38-52$

collecting $13x=14$

$x=1\frac{1}{13}$. Ans.

Mensuration.

The sides of a triangle are 848, 900, and 988 links; find the area in acres.

Half sum of sides

$$=\frac{848+900+988}{2}$$

$=1368$

Area of triangle

$=\sqrt{1368\times(1368-848)\times(1368-900)\times(1368-988)}$

$=\sqrt{1368\times520\times468\times380}$

$=\sqrt{126508262400}$

$=355680$ sq. links.

$=35\cdot5568$ acres. Ans.

Arithmetic.

FEMALES.

1. Divide ·0427 by 92·3 to five places of decimals.

92·3)·04270(·00046...

3692

5780

5538

.....

2. What is the value of 27·225 acres at £120·36 per acre?

£

120·36 × 27·225 = £3276 16s. 0·24d. Ans.

27·225

60180

24072

24072

84252

24072

£3276·801

20

16·020s.

12

0·24d.

3. How long would a ship sailing 7 knots an hour take for a voyage which required 30 days for another vessel whose rate was 8 knots?

7 knots : 8 knots :: 30 days : ?

$\frac{30\text{ das.}\times8}{7}=34\frac{2}{7}$ das. $=34\frac{2}{7}$ days. Ans.

4. What will be the weight of 18 cub. ft. 432 in. of stone, of which 10 cub. ft. 864 inches weigh 12 cwt. 2 qrs. 7 lbs. ?

10 cub. ft. 864 in. : 18 cub. ft. 432 in. :: 12 cwt. 2 qrs. 7 lbs. : ?

or 18144 in. : 31536 in. :: 1407 lbs. : ?

$\frac{1407\text{ lbs.}\times31536}{18144}=2445\frac{1}{2}$ lbs.

$=1$ ton 1 cwt. 3 qrs. $9\frac{1}{2}$ lb. Ans.

Grammar.

1. *Canst* thou with impious obloquy *condemn*
The just decree of God, *pronounced* and *sworn*,
That to his *only* Son, by *right endued*
With regal sceptre, every *soul* in heaven
Shall *bend* the knee?—MILTON.

Analyse the above, parsing the words in italics.

2. Point out in it—

(*a*) Latin prefixes, giving the meaning of each.
(*b*) Any Latin termination.
(*c*) Any *English* affix.

Sentence.	Kind.	Subject.	Predicate.	Object and adjuncts.	Extension.	Connective.
(1) Canst thou with impious obloquy condemn the just decree of God pronounced and sworn.	Principal	thou	canst condemn	the just decree of God, pronounced and sworn	with impious obloquy (manner)	
(2) that to His only Son, by right endued with regal sceptre, every soul in Heaven shall bend the knee?	Subord. noun to (1)	every soul in heaven	shall bend	the knee (*direct*) to His only Son, by right endued with regal sceptre (*indirect*).		that

PARSING.

Canst—auxiliary verb *can, could*, forming with infinitive 'condemn' a compound tense.
Canst condemn—reg. trans. verb, potential, pres. indef., 2nd pers., sing., agreeing with subj. 'thou.'
pronounced—complete part. of reg. verb 'pronounce,' predicate of 'decree.'
sworn—complete part. of irreg. verb *swear, swore, sworn*, predic. of 'decree.'
that—subord. conj., introducing subord. noun sent.
only—adj. qual. 'son.'
right—abstr. noun, neut., sing., obj. gov. by 'by.'
endued—complete part. of reg. verb 'endue,' attrib. to 'son.'
soul—noun, mas. or fem., sing. nom., subj. of 'shall bend.'
bend—irreg. trans. verb, infinitive, pres. indef., gov. by 'shall,' with which it forms future tense.

2. (*a*) Latin prefixes :—

im	in impious	meaning	'not.'
ob	,, obloquy	,,	'against.'
con	,, condemn	,,	'together.'
de	,, decree	,,	'of,' 'from,' 'concerning.'
pro	,, pronounced	,,	'before,' 'for.'
en	,, endued	,,	'in.'

(*b*) Latin terminations :—
ous in impious, *al* in 'regal,' and '*y*' in 'obloquy.'

(*c*) The English affix is *-ly* in only, meaning 'like'; *-st* in 'canst,' and *-d* in 'pronounced' and 'endued,' and the *-n* in 'sworn' are also English terminations.

3. What would you infer as to the origin of words beginning with be, un, mis, gain, and fore? Give examples of each prefix in composition.

One would infer that words beginning with 'be,' 'un,' 'mis,' 'gain,' and 'fore,' were of English or Teutonic origin.
The following are examples of words in which they occur :—besprinkle, bespatter, beware; unknown, unseen, unable; mistake, mishap, mischance; gainsay, against, gain-stay; foretell, foresee, forenoon.

Geography.

[Answer *two* questions.]

1. What are the causes which affect climate? Give illustrations from Northern Africa, Australia, the Russian Empire, and British North America.

The chief causes which affect the climate of a country are : (1) its latitude or distance from the equator; (2) its elevation or height above the level of the sea; (3) its nearness to the sea; (4) the slope of the country; (5) the direction of the mountain-chains; (6) the prevailing winds; (7) the nature of the soil; (8) the rainfall; and (9) even the cultivation or non-cultivation of the soil.

Northern Africa.—The climate of N. Africa is greatly affected by the Atlas Mountains. Between this range and the Mediterranean the country is well watered, but between the Atlas Mountains and the northern limit of tropical rains scarcely any rain falls during the year. In Upper Egypt also no rain falls for several years in succession.

Australia.—As the northern third of Australia is situated in the torrid zone, the climate of that part has periodical rains and a high temperature. In general the climate is considered dry. In the S.E. coast it is remarked there is a constant variation in the climate every six years—wet and dry alternately. The moisture brought by the northern monsoons, which are drawn towards the island in summer by the ascending current, caused by the heat of a vertical sun, is spent on the northern margin in the summer rains. A rainless summer characterises the rest of the country, and the winter rains from the south are limited in a similar manner.

Russian Empire.—Every variety of climate is found in Russia, from the frozen wastes of the parts lying on the confines of the arctic circle, both in Europe and Asia, to the milder climate of the country in the south. On account of so much being continental, the extremes of heat and cold in summer and winter are much greater than in other parts of Europe. The slope to the Arctic Ocean is much colder than the parts sloping south—the summers of the latter being long and hot. In Siberia, the country being almost a dead level, when the frozen rivers thaw, much of their lower basins becomes inundated.

British North America.—The climate of British North America along the St. Lawrence varies greatly, and is subject to great extremes of heat and cold. The mean temperature, however, increases as we go west, and the climate in the east is mitigated by the ocean. In Western Canada the climate is rendered milder by reason of the southerly position of the country, and also on account of the influence of the large inland lakes which almost surround this part of the Dominion. The Rocky Mountains are supposed to bend the trade-wind coming from the Gulf of Mexico across the lower watershed, between the basin of the Mississippi and that of the Mackenzie River, so as to moderate the climate of the north-west territory. The northern coast is entirely Arctic.

2. Give notes of a first lesson on China, *or* on 'the rivers of Africa flowing into the Atlantic Ocean.'

N.B.—*No Introduction.*—Frame your notes so as to bring out the real features of the country, and make a good descriptive lesson.

NOTES ON CHINA.

PHYSICAL FEATURES.—*Surface and Mountains.*—Eastern half consists mainly of the lower basins of the Peiho, Hoangho, Yangtse, and Canton Rivers; mostly a great alluvial plain, celebrated for its fertility and density of population; western half is highly mountainous; the Yunling runs N. and S. between the upper courses of the Hoangho and Yangtse; from this range three other ranges proceed eastward to near the coast, namely, the Yu-ling, S. of the Canton River; the Nan-ling, between the Canton River and the Yangtse; and the Peling between the Yangtse and the Hoangho. The coasts are low and in some parts swampy, except between the mouths of the Canton River and the Yangtse, where they are high and rocky. *Rivers*—No country is better watered; the Yangtse crosses the central par from W. to E.; the Hoangho, next in size, and joined to the former by the Grand Canal, is said to furnish the most magnificent system of water communication in existence. The *Lakes* are mere enlargements on the rivers, and, though numerous, are not of great extent.

PEOPLE.—The learned men are held in great honour, and occupy all the important offices of state. The notions of female beauty are peculiar, small feet being objects of great admiration. The religion of the upper classes is that of Confucius, and that of the lower orders is a species of Buddhism. Of the national work of China, the most remarkable is the *Great Wall* on the northern frontier, built to repel the Tartars.

Rice, the principal food, is eaten with chop-sticks, requiring much art to use; pork is a favourite meat, but dog's flesh is considered a delicacy, and even rats and mice are relished by the lower orders; tea is drunk without cream or sugar, and a great luxury is the edible birds'-nests from Java.

The people are very deceitful, and in their vanity call their country the 'Celestial Empire.' They are very skilful in carving ivory, but their paintings show no knowledge of perspective.

NOTES ON THE RIVERS OF AFRICA FLOWING INTO THE ATLANTIC.

The rivers of Africa flowing into the Atlantic are the *Senegal, Gambia, Niger, Congo*, and *Orange*.

Of these the *Senegal*, the *Gambia*, and the *Niger* have their origins in the mountains near the coast of Senegambia. In the rainy season the *Senegal* is navigable for about 600 miles, and in the dry season for about a fourth of that distance. The *Gambia* takes a winding course to the west, and is navigable for 400 miles, nearly the whole of its extent. The greatest of these rivers is the *Niger*, called by the natives in the upper part of its course the *Joliba*, and lower down the *Quorra*, enters the ocean by a number of mouths, the most distant of which are 200 miles apart. It is navigable for light vessels above Timbuctoo. The sources of this river were discovered in 1879 by a French expedition, which started from the coast of Sierra Leone. Its head waters are formed by two streams, both of which have their origin in the Loma Mountains.

The *Congo*, the second in extent of basin and the greatest in volume of the African rivers—so characterised by Stanley, who explored it in 1876-77—rises in the mountains above Lake Nyassa and falls into Lake Bangweolo, from which it issues under the name *Luapula*, and flows north to Lake Moero. From

the north side of this lake issues the *Lualaba*, which passes through a magnificent series of lake expansions, and receives numerous tributaries. About the place where this river crosses the equator there are six falls, and further on there begins a series of cataracts and rapids, which interrupt the navigation for about 110 miles. Unlike most African rivers, the Congo forms an estuary at its mouth. It is estimated to pour into the ocean a larger body of water than the Mississippi.

The Orange River, though it rises near the eastern coast and flows nearly across the Continent, passes for the greater part of its course through the desert, receives the Vaal, and is a shallow stream. The country on the Vaal has of late years attracted attention as the deposit of perhaps the richest diamond fields in the world. The obstructions in its bed are likely to hinder its ever becoming a great commercial highway.

3. Describe, *as for children*, the Trade Winds and the Gulf Stream.

Draw a map, in illustration of *one* answer. Insert the lines of latitude and longitude.

TRADE WINDS.

The air that lies over the torrid zone, becoming heated by contact with the warm surface, floats upwards, and currents of cooler air from the regions northward and southward flow in to take its place, while the heated air flows over the top towards the poles. If the earth were at rest, these currents would blow exactly north and south, but the revolution of the globe changes their direction. By watching an artificial globe turning on its axis you will observe that any spot near the equator travels faster than a spot nearer the poles, because it has a much longer road to travel. Now as the earth revolves, the atmosphere is carried with it, and every portion of it has the same velocity as the place on which it lies. Now when air begins to move from the north towards the equator it is constantly coming to places moving with greater and greater speed, and before it has time to acquire this additional speed, it, as it were, falls behind, and instead of flowing directly south, it flows towards the south-west, that is, instead of a north wind it becomes a north-east—winds being named from the quarters *from* which they blow.

In a similar way the current from the south becomes a south-east wind.

It is only at sea within the tropics and at some distance beyond them that the polar currents from the north-east and south-east are able to make themselves sufficiently felt. They are there known as the *Trade Winds*, because they are so constant that they can be calculated on by navigators. Ships entering upon this belt begin to feel a steady easterly breeze. The two currents from north and south flow towards the equator, and between them is a space from three hundred to four hundred miles in breadth, forming what is called the region of *calms* and *variables*.

GULF STREAM.

The main stream of the great Atlantic current sweeps past the coast of S. America, passes through the Windward Islands, across the Caribbean Sea, and into the Gulf of Mexico. As the current sweeps round the gulf it becomes very hot, and is swollen by the waters of the Mississippi, till at length it forces its way out into the Atlantic between Florida and Cuba, in a stream of from 30 to 40 miles wide and 600 or 700 feet deep, and at a speed of about 80 miles a day. At first it keep pretty close to the coast of America, but by degrees widens out, and bears away to the east, running between Newfoundland and the Azores. There it parts. The main body turns round the Azores, and goes off southwards between those islands and Spain down to the African coast. The other portion runs on northward between Britain and Iceland, giving warmth and moisture to Cornwall, Ireland, the Hebrides, and the Shetland Islands. The northward motion of the *Gulf Stream*, as the current is called, necessitates a southward motion from the Polar Seas. Immediately beneath the Gulf Stream, and on the inner or land side of it, runs a current of cold water past Labrador to replace the warm water brought up from the tropics.

SECOND PAPER.

Two hours and a half allowed.

Arithmetic.

MALES.

1. Find the square root of 169·476 to 4 decimal places; and show that the square root of 4·694 = 2·16.

(*a*)

$$\begin{array}{r|l} 1 & 169\cdot476(13\cdot0182.\quad \text{Ans.} \\ 1 & \\ \hline 23 & 69 \\ & 69 \\ \hline 2601 & 4760 \\ & 2601 \\ \hline 26028 & 215900 \\ & 208224 \\ \hline 260362 & 767600 \\ & 520724 \\ & \cdots \end{array}$$

(*b*)

$$4\cdot694 = 4\tfrac{694}{1000} = 4\tfrac{347}{500} = \tfrac{2347}{500}$$

$$\text{and } \sqrt{\tfrac{2347}{500}} = \tfrac{153}{70} = 2\cdot16. \qquad \text{Q. E. D}$$

2. If a grocer pays £65 for 4 cwts. of tea, how must he sell it per lb. to gain 12 per cent.?

100 : 112 :: £65 : selling price of 4 cwts.

$$\frac{£65 \times 112}{100} = £72\ 16\text{s.} = \text{selling price of 4 cwt.}$$

$$\therefore \frac{£72\ 16\text{s.}}{4\text{ cwt.}} = \frac{1456\text{s.}}{448\text{ lbs.}} = 3\text{s. }3\text{d.}, \text{ price of 1 lb. Ans.}$$

3. What is meant by true discount, and by banker's discount? Find the difference between banker's and true discount on a bill of £772 10s. due 8 months hence, interest being at 4½ per cent. per annum.

In discounting bills, bankers and merchants calculate *interest* instead of discount, on the sum drawn for in the bill, from the date of their discounting it to the time when it becomes due. *This discount* is greater than the *true discount* by the interest on the latter for the time that the bill has still to run.

(*a*) Interest on £100 for 8 mos. at 4½ p.c. = $4\tfrac{1}{2} \times \tfrac{8}{12} = £3$

Amount " " " = £103

∴ 103 : 3 :: £772½ : true discount

$$£772\tfrac{1}{2} \times \tfrac{3}{103} = \frac{1545 \times 3}{2 \times 103} = \tfrac{45}{2} = \begin{array}{rrr} £ & \text{s.} & \text{d.} \\ 22 & 10 & 0 \end{array}$$

$$\text{Interest} = £772\tfrac{1}{2} \times \frac{4\frac{1}{2}}{100} \times \tfrac{8}{12} = £\tfrac{927}{40} = \begin{array}{rrr} 23 & 3 & 2\frac{2}{5} \end{array}$$

Diff. in favour of bank 0 13 2½ Ans.

4. A man invests £6368 in the 3 per cents. at 99½, and on their rising to 101⅞ he sells out and re-invests the money in 4 per cent. debentures at 125. Find the increase in his income.

(*a*) 99½ : 101⅞ :: £6368 : sum to be re-invested

$$£6368 \times \frac{101\tfrac{7}{8}}{99\tfrac{1}{2}} = \frac{£6368 \times 815}{796} = £6520$$

(*b*) 125 : 6520 :: £4 : income from debentures.

$$\frac{£4 \times 6520}{125} = £\tfrac{208}{25} = \begin{array}{rrr} £ & \text{s.} & \text{d.} \\ 208 & 12 & 9\frac{3}{5} \end{array}$$

(*c*) 99½ : 6368 :: 3 : 1st income

$$\frac{£3 \times 6368}{99\tfrac{1}{2}} = \frac{£2 \times 12736}{199} = \begin{array}{r} 192\ 0\ 0 \end{array}$$

Increase = 16 12 9⅗. Ans.

History.

1. Who was James I.? Describe his character.

James I. was the nearest heir to the English throne after the death of Elizabeth. He was descended from Henry VII., whose daughter, Margaret married James IV. James V. son of James IV., was the father of Mary, Queen of Scots, mother of James VI., who on succeeding to the English throne became James I.

The character of James was in many respects singular. To great capacity for learning and abilities by no means contemptible, he united a degree of meanness, cowardice, and vanity, which accorded but ill with his lofty ideas of the divine rights and authority of sovereigns. He was disposed to govern despotically, but he was deficient in the vigour and tact which enabled Elizabeth to rule in the hearts of her people.

2. What is the Septennial Act? What was the duration of Parliament before the Act?

The Septennial Act limits the duration of Parliament to seven years; that is, there must be a general election of members at least every seven years. Before the passing of this Act the duration of Parliament was limited to three years, by what was called the Triennial Act passed in the reign of William III. The Septennial Act was passed in the reign of George I.

3. Why has England always prized her Navy? Name three naval heroes, and describe the chief exploits of one of them.

England has always prized her navy on account of the protection which it insures from foreign invasion, and the victories with which it has upheld the British flag on every sea. A better answer to this question could not be given than in the words of Campbell's stirring poem, 'Ye mariners of England,' the sentiment of which, although poetical, is almost literally true.

Rodney, Jervis, and Nelson were naval heroes, and the chief exploits of the latter were as follows:—

In 1798, at the Battle of the Nile, the English (with fourteen ships) under Nelson, defeated the French (seventeen ships), under Admiral Brueys. Nine of the enemy's ships were captured.

In 1801 Lord Nelson bombarded Copenhagen. The whole Danish fleet was captured or destroyed, and the town compelled to surrender.

In 1805, off Trafalgar, the British fleet of twenty-seven sail and four frigates under Lord Nelson, engaged the French and Spanish under Admirals Villeneuve and Gravina (thirty-three sail and five frigates). Nineteen of the enemy's ships were captured, but Nelson was killed in the hour of victory.

Teaching.

Write out simple notes of a lesson on an *Adjective*, with examples.

NOTES ON AN ADJECTIVE.

I. Introduce subject by asking for the names of things that the children would like, and answers such as 'apple,' 'orange,' 'watch,' 'doll,' will be elicited. Then question them as to the kind of 'apple' they would like, and 'good,' 'large,' 'ripe,' etc., may be given. Proceed in the same way with 'orange,' and vary it with questions as to the *kind* they would *not* like, when they will probably give 'bad,' 'small,' 'unripe,' 'bitter.'

II. The nature of the adjective may be further shown by inquiring *how many* oranges, apples, dolls, etc., the children would like. One may answer 'two,' another 'six,' and so on. Advantage may be taken by the answer to show the different characters of the children who furnish the answer. One was a *modest* child, another *greedy*; etc. Now write the word 'Adjective' on the blackboard, and explain that those words which they have been putting to the names or nouns are adjectives, and so draw from them that the use of adjectives is 'to tell about the nouns as to what kind they are, how many there are of them, and which ones are meant.'

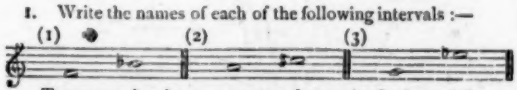
III. Write on the blackboard Adjectives of Quality:—*tall, good*, etc. Adjectives of Quantity:—*two, many, much*, etc. Adjectives of Distinction:—*this, yon, former*, etc. Exercise from reading-books.

IV. Exercise on formation of Adjectives; *from nouns*, as man, man*ly*; child, child*like*, child*less*; harm, harm*ful*; hurt, hurt*ful*, etc.: *from adjectives*; *dis*honest; *un*fortunate, etc.: *from verbs*; forget*ful*, exhaust*less*, blow*y*, *un*fed, etc.

Music.

A quarter of an hour allowed for this paper.

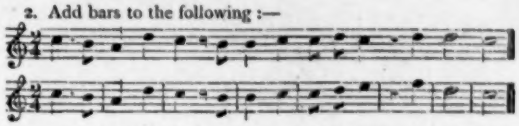
1. Write the names of each of the following intervals:—



Transpose the above one octave lower, in the bass clef.

1.

2. Add bars to the following:—



3. Explain the following terms:—(1) *Crescendo*. (2) *Forte*. (3) *Rallentando*.

3. (1) Increasing (in loudness). (2) Loud. (3) Slackening (the pace).

TONIC SOL-FA NOTATION.

1. What is the interval (*a*) between *me* and *fah*, (*b*) between *ray* and *fah*, (*c*) between *me* and *doh*? What is the name (*d*) for *soh* sharp, (*e*) for *te* flat?

1. (*a*) Minor second. (*b*) Minor third. (*c*) Minor sixth. (*d*) *se*. (*e*) *ta*.

2. Re-write the following in two-pulse measure, halving the value of each note:—

‖m :— |s :l |r :-.m |f :m ‖

2.

‖m :s .l |r .m :f .m ‖

3. Explain the following terms:—(*a*) *Crescendo*, (*b*) *Forte*, (*c*) *Rallentando*.

3. (*a*) Increasing (in loudness). (*b*) Loud. (*c*) Slackening (the pace).

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

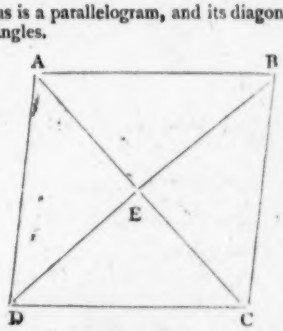
[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including Question 3, if possible.

1. In any right-angled triangle, the square which is described upon the side subtending the right angle is equal to the squares described upon the sides which contain the right angle.

2. In obtuse-angled triangles, if a perpendicular be drawn from either of the acute angles to the opposite side produced, the square on the side subtending the obtuse angle is greater than the squares on the sides containing the obtuse angle, by twice the rectangle contained by the side upon which, when produced, the perpendicular falls, and the straight line intercepted without the triangle between the perpendicular and the obtuse angle.

3. A rhombus is a parallelogram, and its diagonals bisect each other at right angles.



Since ABCD is a rhombus, its four sides are equal to one another. Join BD. Then (I. 4) the triangles BAD, BCD, are equal in every respect; and ∴ ∠ABD = ∠BDC, and they are

alternate angles, wherefore (I. 27) AB is parallel to DC. For the same reason $\angle DBC = \angle BDA$. $\therefore$ BC is parallel to AD, and hence ABCD is a parallelogram.

Again, by joining AC it will cut BD at right angles in E. For because BA = AD, and AE is common to the two triangles BAE, DAE, and $\angle ABE = \angle ADE$ (I. 5), then (I. 26) the triangles are equal in every respect. $\therefore$ BE = ED and $\angle AED = \angle AEB$ and they are adjacent angles, $\therefore$ (I. 13) each of them is $\angle$ right. In the same way it may be shown that AE = EC, and $\therefore$ the diagonals AC, BD bisect each other at right angles in the point E.

Algebra.

MALES.

Answer two Questions.

1. Find the value of $\frac{x+2a}{x-2a}+\frac{x+2b}{x-2b}$ when $x=\frac{4ab}{a+b}$

Substituting for value of x

$$\frac{\frac{4ab}{a+b}+2a}{\frac{4ab}{a+b}-2a}+\frac{\frac{4a}{a+b}+2b}{\frac{4a}{a+b}-2b}=\frac{4ab+2a^2+2ab}{4ab-2a^2-2ab}+\frac{4ab+2ab+2b^2}{4ab-2ab-2b^2}$$

$$=\frac{6ab+2a^2}{2ab-2a^2}+\frac{6ab+2b^2}{2ab-2b^2}$$

$$=\frac{3b+a}{b-a}+\frac{3a+b}{a-b}$$

$$=\frac{3b+a}{b-a}-\frac{b+3a}{b-a}$$ (by exchanging signs of each term)

$$=\frac{2b-2a}{b-a}=\underline{2}.$$ Ans.

2. Find the coefficient of x^3 in the square of

$$1-2x+3x^2+4x^4-x^7.$$

Since x^6 is obtainable from the products of $-2x$ and $-x^7$; of $4x^4$ and $4x^4$; and of $-x^7$ and $-2x$; which are $2x^3, +16x^8+2x^8$.

By adding these results the sum is $20x^8$, of which the coefficient is 20. Ans.

3. Solve the equations—

$$(1)\ \frac{2x+y}{9}+\frac{7y+6x+11}{18}=\frac{19}{2}-\frac{5x-17}{6}$$

$$\tfrac{3}{7}(5x+3y+2)=\tfrac{1}{2}(9y+6).$$

$$(2)\ (x+2\tfrac{1}{17})^2-15(x+2\tfrac{1}{17})+56=0.$$

(1) Clearing first half of fractions,

$$4x+2y+7y+6x+11=171-15x+51$$
$$4x+6x+15x+2y+7y=171+51-11$$
$$25x+9y=211$$

Clearing second half of fractions,

$$30x+18y+12=63y+42$$
$$30x-45y=30$$
$$6x-9y=6$$

But $25x+9y=211$

By addition, $31x=217$

$\therefore\ x=\underline{7}$. Ans.

By substitution, $y=\underline{4}$. Ans.

$$(2)\ (x+2\tfrac{18}{17})^2-15(x+2\tfrac{1}{17})+56=0$$

Breaking up into factors,

$$\{(x+2\tfrac{1}{17})-7\}\{(x+2\tfrac{1}{17})-8\}=0$$

Hence $(x+2\frac{1}{17})-7=0$; or $(x+2\frac{1}{17})-8=0$

$x+2\frac{1}{17}=7$; $x+2\frac{1}{17}=8$

$17x+35=119$; $17x+35=136$

$17x=119-35$; $17x=136-35$

$17x=84$; $17x=101$

$x=\underline{4\frac{16}{17}}$. Ans. $x=\underline{5\frac{16}{17}}$. Ans.

Mensuration.

MALES.

The radius of the inner boundary of a ring is 14 inches; the area of the ring is 100 square inches. Find the radius of the outer boundary.

Area of inner circle = square of diameter $\times$ ·7854

" " " $= 28^2 \times$ ·7854

" " " $= 784 \times$ ·7854 = 615·7536 sq. in.

Area of whole circle enclosed by outer boundary = 100 + 615·7536

" " " " = 715·7536 sq. in

Diameter of " " " $= \sqrt{\frac{715\cdot7536}{\cdot7854}}$

" " " " $= \sqrt{911\cdot324}$

" " " " = 30·189

Hence radius of outer boundary = $\underline{15\cdot095}$ nearly. Ans.

Arithmetic.

FEMALES.

1. What sum will amount in $4\frac{1}{2}$ years to £1209 8s. $7\frac{3}{4}$d. at 5 per cent. simple interest?

	£	s.
Interest of £100 for $4\frac{1}{2}$ years at 5 p. c. =	22	10,
Amount " " " =	122	10;

$\therefore$ £$122\frac{1}{2}$: £100 :: £1209 8s. $7\frac{3}{4}$d. : sum required.

$$\frac{\text{£}1209\ 8\text{s. }7\frac{3}{4}\text{d.} \times 100}{122\frac{1}{2}}=\frac{1,161,055 \text{ far.} \times 200}{245}$$

$$=23{,}695 \text{ far.} \times 40$$

$$=947{,}800 \text{ fars.} = \underline{\text{£}987\ 5\text{s. }10\text{d.}}$$ Ans.

2. From 235 tons of óre from a mine A are obtainable 12 tons 10 cwt. of metal, and from $164\frac{1}{2}$ tons from a mine B, 8 tons 9 cwt. of metal; how much higher is the percentage of metal in one case than in the other?

(*a*) 235 : 100 :: $12\frac{1}{2}$: p. c. of A.

$$\frac{12\frac{1}{2}\times 100}{235}=\frac{25\times 100}{470}=5\tfrac{17}{47}$$ 1st percentage.

(*b*) $164\frac{1}{2}$: 100 :: $8\frac{9}{20}$: p. c. of B.

$$\frac{8\frac{9}{20}\times 100}{164\frac{1}{2}}=\frac{169\times 100}{3290}=\frac{1000}{235}=5\tfrac{7}{47}$$ 2nd percentage.

Diff. of percentage between A and B = $5\frac{17}{47}-5\frac{7}{47}=\underline{\frac{10}{47}}$. Ans.

3. A person sold out at $98\frac{3}{4}$ some stock on which at $4\frac{1}{2}$ per cent. he had received £173 9s. 6d. interest; what would he obtain for it?

$4\frac{1}{2}$: $98\frac{3}{4}$ :: £173 9s. 6d. : amount obtained.

$$\frac{\text{£}173\ 9\text{s. }6\text{d.} \times 98\frac{3}{4}}{4\frac{1}{2}}=\frac{\text{£}173\ 9\text{s. }6\text{d.} \times 395}{18}$$

$$=\frac{41{,}634\text{d.} \times 395}{18}$$

$$=2313\text{d.} \times 395$$

$$=913{,}635\text{d.} = \underline{\text{£}3806\ 16\text{s. }3\text{d.}}$$ Ans.

4. If 120 qrs. of wheat last 1500 persons for 28 days, how long would 342 qrs. last 2100 persons?

120 qrs. : 342 qrs.
2100 pers. : 1500 pers. } :: 28 days : time.

$$\frac{28 \text{ days} \times 342 \times 1500}{120 \times 2100}=\underline{57 \text{ days.}}$$ Ans.

Grammar.

1. 'God, when He gave me strength, *to show withal*
How slight the gift was, hung it in my hair.
But *peace*, I *must* not *quarrel* with the *will*
Of *highest dispensation*, which *herein*
Haply had *ends* above my *reach* to know.'
—'SAMSON AGONISTES.'

Analyse the above, parsing the words in italics.

SENTENCE.	KIND.	SUBJECT.	PREDICATE VERB.	COMPLETION.	EXTENSION.	CONNECTIVE.
(1) God, to show withal...hung it in my hair.	Principal	God	hung	it (strength)	in my hair (place) to show withal (purpose)	
(2) When He gave me strength.	Subord. adv. to (1)	He	gave	strength (*dir. obj.*) me (*indir. obj.*)		when
(3) How slight the gift was.	Subord. noun to (1)	the gift	was	how slight		how
(4) But I must not quarrel with the will of highest dispensation.	Principal	I	must not quarrel with	the will of highest dispensation		but
(5) Which herein haply had ends above my reach to know.	Subord. adj. to (4)	which	had	ends above my reach to know	herein	which

Note.—'Peace,' being exclamatory, may be omitted, though it might be considered as object. to such a sentence, 'I must hold my peace.'

PARSING.

To show—irreg. trans. verb, *show, showed, shown*, infin., pres. indef., gov. by 'hung.'
withal—adv. of degree, mod. 'to show.'
peace—abst. noun, neut., sing., obj., gov. by some word like 'hold' understood.
must—aux. verb, forming with the infinitive 'quarrel' a compound tense.
must quarrel—reg. intrans. (but 'with' makes it trans.), potential, pres. indef., 1st pers., sing., agr. with 'I.'
will—abst. noun, neut., sing., obj., gov. by 'with.'
highest—adj., superb. deg., qual. 'dispensation.'
dispensation—abst. noun, neut., sing., obj., gov. by 'of.'
herein—adv. (place), mod. 'had.'
haply—adv. (manner), mod. 'had.'
ends—abst. noun, neut., plural, obj., gov. by 'had.'
reach—,, ,, ,, sing., ,, ,, 'above.'

2. Point out any words in the above derived from the Latin, and give the Latin root of the following words:—Port, street, pound, table, duke, captive, fact, charity, leopard.

Peace, quarrel, dispensation, are the only words from the Latin. Port is from porto; street from stratum; pound from pondus; table from tabula; duke from duco; captive from capio; fact from facio; charity from carus; leopard from leo and pardus.

3. How do you account for a Scandinavian element in the English language, and in what words is it most traceable?

In consequence of the incursions of men of Scandinavian race (who were of the Teutonic stock), many Scandinavian words made their way into common use, and these appear in many names of places in the districts occupied by the Scandinavian invaders, such as *by*, meaning a 'town,' as Grimsby, Whitby, Holmby; *Scaw*, a 'wood,' as Scawfell; *force*, a 'waterfall,' as Stockgill Force; *ness*, 'headland,' as in Furness; *ey*, an 'island,' as Bardsey; *beck*, a 'stream,' as in Holbeck.

4. Mention some of the great writers of the fourteenth and the eighteenth centuries.

Fourteenth century—Chaucer, Wycliffe, Longlande, Sir John Mandeville, John Gower.

Eighteenth century—Pope, Addison, Steele, Swift, Samuel Johnson, Thompson, Richardson, Fielding, Smollett, Gray, Hume, Defoe, Adam Smith, Gibbon, Goldsmith, Burns, and Cowper.

Geography.

1. Give 'notes of a lesson' on 'An Eclipse of the Moon, its causes, its appearance, and what may be learnt from it about the shape of the Earth.'

ECLIPSE OF THE MOON.

CAUSE OF THE ECLIPSE.—Eclipses (from Gr. *ekleipsis*, a failing or disappearing) caused by the positions of the earth and moon with respect to each other, and to the sun. An eclipse of the sun takes place when the moon is between the sun and the earth; and an eclipse of the moon is the result of the earth being between the sun and the moon (*to be illustrated by diagram*).

APPEARANCE.—The moon, in common with all the planets and satellites, shines by reflected light derived from the sun. When the sun, the earth, and the moon are in the same line, the earth will intercept the rays of the sun, and *cast a shadow* on the moon, thereby causing an eclipse of the moon. Such eclipses never happen but at the exact time of full moon. Her orbit is inclined to that of the earth at an angle of 5° 9′, but for which we should have an eclipse of the sun and moon alternately every fortnight.

PROOF OF EARTH'S ROTUNDITY.—Again, this shadow, which is plainly seen to enter upon and eat away, as it were, the moon's disc, is always terminated by a circular outline, though from the greater size of the circle it is only partially seen at any one time. Now a body which always casts a circular shadow must itself be spherical. The fact is therefore a convincing proof that the world is round.

2. Describe the course of a vessel, sailing from New York to Melbourne by way of Cape Horn, and returning by the Cape of Good Hope. Mention, in their proper places, the chief ocean currents it would meet, the points where it would cross the equator, the islands in its route, and any changes of climate at different parts of the voyage.

Illustrate your answer by a map of Patagonia with the Terra del Fuego, *or* of New Zealand, *or* of the Caribbean Sea. Insert the lines of latitude and longitude.

Leaving New York, and passing the Island of Manhattan, we encounter the Gulf Stream, which impedes our progress somewhat as we proceed in a south-easterly direction through the south part of the north temperate zone. As we enter the torrid zone we have the East India Islands on our right, cross the path of the North Atlantic Current, and feel the opposing force of that part of the Atlantic Current called the Equatorial Stream, as we cross the equator, 30° W. long., under the burning rays of a tropical sun. Now, taking advantage of the Brazil Current, we steam down the coast of South America, pass the Falkland Islands on our right, and encounter the Cape Horn Current while doubling Cape Horn to the south of Terra del Fuego. Our voyage now is across the south margin of the Pacific Ocean, almost at right angles with the drift currents of the Antarctic Ocean, past New Zealand and Tasmania to Melbourne. From Brazil to Cape Horn the climate was temperate, round Cape Horn it was almost arctic, and as we neared New Zealand it was temperate again.

Leaving Melbourne, on our homeward voyage, we enjoy a temperate climate, but meet the antarctic drift currents again as we skirt the Indian Ocean to the Cape of Good Hope, when we enter the Atlantic Ocean and voyage to the north-west, and pass St. Helena and Ascension Islands. A little to the south of St. Helena, we leave a temperate for a tropical climate, cross the equator, assisted by the Atlantic Current, and continue north-west, keeping the West India Islands to the left. We re-enter the north temperate zone at the Bahama Islands, and immediately after obtain the assistance of the Gulf Stream to carry us to New York.

SECOND PAPER.

Two hours and a half allowed.

Arithmetic.

MALES.

1. A woman buys eggs at 5 for 3d. and sells them at 10d. a dozen. Find the gain per cent.

d. d.
Price of 1 egg at 5 for 3d. $= \frac{3}{5}$ or $\frac{12}{20}$,
" 1 " 10d. per doz. $= \frac{5}{6}$ or $\frac{10}{20}$.

Gain on $\frac{1}{20}$d. $= \frac{25 - 18}{30} = \frac{7}{30}$;

$\therefore$ 18 : 100 :: 7 : gain p. c.

$\frac{700}{18} = \frac{350}{9} = \underline{38\frac{8}{9}}$. Ans.

2. A man leaves his property to his four sons, whose shares are to be as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$. The share of the youngest amounts to £3600; find the shares of the others.

$\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{30 + 20 + 15 + 12}{60} = \frac{77}{60}$

Now since the youngest gets £3,600, which equals 12 shares,

£ £
then 12 : 30 :: 3600 : 9000 share of eldest. Ans.
12 : 20 :: 3600 : 6000 " 2nd. Ans.
12 : 15 :: 3600 : 4500 " 3rd. Ans.

3. One man invests money in the 3 per cents. at 98, and another in railway stock at 125, paying a dividend of $3\frac{3}{4}$ per cent. Compare the rates of interest which the two get.

£98 brings an income of £3 $:= \frac{3}{98}$ for £$= \frac{3000}{98}$,
£125 " " £$3\frac{3}{4} = \frac{15}{4 \times 100} = \frac{3}{80}$ " $= \frac{3000}{8000}$;
$\therefore$ the rates are to each other as 300 : 294 or as 50 : 49. Ans.

4. A farmer buys 40 sheep at £2 10s. each, and sells 10 of them at a loss of 4 per cent. At what price must he sell the remainder so as to gain 8 per cent. on the whole lot?

£
40 sheep at £2 10s. each = 100.
$\therefore$ 8 p. c. gain on whole = 108,
£2 10s. $\times$ 10 = £25 value of 10 sheep.
$\therefore$ 100 : 96 :: £25 : what he got for 10 sheep,

$\frac{£25 \times 96}{100} = £24$.

Now since he must get £108 for the whole, the remainder must bring (£108 − 24) = £84:
$\therefore$ the price of each of the remaining 30 = £$\frac{84}{30}$ = £2 16s. Ans.

History.

1. Who were the parties to the Great Charter? Do you think that feudalism was weakened by any of its provisions?

The parties to the Great Charter were King John on the one side, and the barons, headed by Archbishop Stephen Langton, on the other. John at first swore that he would never grant them liberties which would make him a slave, but when the confederates marched under Fitz-Walter upon London, and were willingly admitted, he was brought to submit. At Runnymede, in June, 1215, the king met the barons and sealed the Charter. It was no new law, but rather a correction of abuses. The first clause secured the liberties of the English Church; others were framed for removing the grievances of the barons as tenants of the crown. It was not the advance of a single step towards liberty, but the making sure of steps already taken. The serfs were left in the same bondage they had ever been in.

2. Upon what grounds was payment of ship-money resisted in Buckinghamshire?

John Hampden, a gentleman of Buckinghamshire, refused to pay ship-money because it was illegal, which illegality was shown by the tax being levied in a time of profound peace; by inland counties being burdened with it, which had never happened before; by the money being applied to keep up an army, instead of a fleet; and, most of all, because it was levied by the authority of Charles I. and not by the authority of Parliament.

3. What extensions of territory have we acquired in the last century? How are people at home interested in such extensions.

During the last hundred years there have been added to the British Empire the following territories, islands, etc., namely, during the reign of George III.:—Sierra Leone, New South Wales, Norfolk Island, Seychelles, Ceylon, Trinidad, Guiana, Tasmania, Auckland, Cape Colony, Heligoland, Mauritius, Ionian Islands (since restored), Ascension Islands, and a considerable portion of India.

During the reign of George IV. were added: Singapore, Assam, Arracan, Tenasserim, and Western Australia.

Victoria was colonised and South Australia settled under William IV., and during the present reign Aden was taken, New Zealand made a colony, Falkland Islands colonised, Hong Kong ceded, Natal proclaimed a colony; various portions of India annexed, Labuan ceded, Vancouver Islands settled, British Columbia made a colony, Perim occupied, and latterly, Fiji Islands and Cyprus taken over, the latter by purchase.

The people at home are very much interested in these extensions, because some afford a home for thousands of poor who find it a hard struggle to live in their own country; others are valuable as stations to shelter our fleets, and therefore protect our commerce; others are valuable as trading stations; and others are particularly valuable as stations, or half-way houses at which ships call for provisions, water, or coal.

Teaching.

Write notes of a lesson on *Birds*.

OBJECTS TO BE SEEN.—*Stuffed specimens of birds, if possible, and pictures to show relative sizes, etc.*

APPEARANCE AND PARTS.—Being destined to live in air, all their parts adapted to their destined situation, shape of body adapted to swiftness of motion (*show how*); may be compared to a ship making its way through the water, the body answering to the hull, the head to the prow, the tail to the rudder, and the wings to oars or sails (*these to be explained, if necessary*). Their covering of neatly-placed feathers lying all one way, giving warmth, speed, and security (*show arrangement of feathers*); soft down next body for warmth; outside more strongly fortified against the weather. Wings placed at such a part of the body as to balance the whole and support it in air; resemble the fore legs of quadrupeds; furnished with quills, which have broad beards on one side and narrower ones on the other (*elicit from class, if possible, how the bird flies—it bounds; strikes the air with expanded wings; contracts them; spreads them again*, and so on); birds supplied with oil to dress their plumage (*explain*); some perch or go to roost (*explain why the birds cannot fall off when sleeping*).

KINDS.—Land birds: Water-fowl (*draw out names*):

Six orders.—1. Birds of prey (vulture, falcon, eagle).
2. Perching-birds (nearly all singing-birds).
3. Climbing-birds (parrot, parroquet, woodpecker).
4. Scrapers (pheasants, common hen).
5. Waders, or Stilt-birds (heron, stork, crane).
6. Web-footed birds (duck, goose, gull).

It has been proposed to separate the *short-winged birds* (ostrich, emu) into a separate order.

WHERE THEY LIVE.—Greater part of birds of prey, waders, and web-footed birds live in all quarters of the world; the other orders prefer, as a general rule, the warm temperate regions, *not* being found in the extreme north, nor in the equatorial climes except in limited numbers.

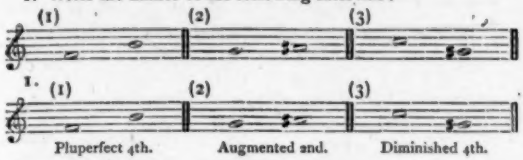
USES.—Birds embellish the forest; amuse our walks; exclude solitude from our most shady retirements; their pleasures, affections, and even their battles enliven the general picture of nature. Birds' *feathers*, used as ornaments and for stuffing; *eggs* for food; *game* for food, and employment to sportsmen; ostrich-farming a very lucrative trade; *quills* used for *pens*; some birds kept for amusement, and some for their beauty.

(*Draw out from the children all they know about pet-birds, and those they may have seen at zoological gardens, menageries, etc.*)

Music.

A quarter of an hour allowed for this paper.

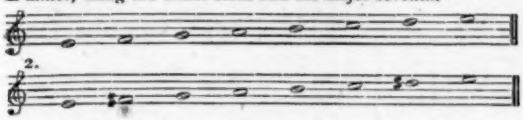
1. Write the names of the following intervals :—



1. (1) (2) (3)

Pluperfect 4th. Augmented 2nd. Diminished 4th.

2. Write before the notes the sharps essential to the scale of E minor, using the minor sixth and the major seventh.



2.

3. Explain the following terms :—(1) *Allegro.* (2) M. 60. (3) *Presto.*

3. (1) Merry, lively. (2) M. 60. placed before a tune means that the pulses of that tune move at the rate of 60 in a minute. (3) Quick.

TONIC SOL-FA NOTATION.

1. What is the interval (*a*) between *fah* and *te*, (*b*) between *doh* and *re*, (*c*) between *doh* and *se*?

1. (*a*) Pluperfect fourth. (*b*) Augmented second. (*c*) Diminished fourth.

2. Write the minor scale in any one form.

2. *lah, te, doh ray me fah se lah*

3. Explain the following terms: (*a*) *Allegro.* (*b*) M. 60. (*c*) *Presto.*

3. (*a*) Merry, lively. (*b*) M. 60. placed before a tune means that the pulses of that tune move at the rate of 60 in a minute. (*c*) Quick.

Physiology.

BY ARTHUR NEWSHOLME, M.D. LOND.,

Gold Medallist and University Scholar, Physician to the City Dispensary.

CHAPTER V.—THE STRUCTURE OF THE SKELETAL TISSUES.

Cartilage or gristle is found in two forms—*temporary* and *permanent.* From the former a large proportion of the bones of the skeleton are developed, the cartilage being transformed into bone. Permanent cartilage is found in many positions. It tips the articular surfaces of bones, rendering them smooth and shiny; it is wedged between bones that are imperfectly movable, as in the inter-vertebral discs, where it prevents any serious concussion; in some places it connects bones together, as the ribs and the sternum (costal cartilages); in others it serves to keep open orifices of the body—the lower part of the nose consists of it—and the margin of the eyelids; or it preserves the patency of tubes in the interior of the body—thus the Eustachian tube, leading from the side of the throat to the middle ear, consists of it, and the trachea and bronchial tubes contain a large amount.

Classifying cartilage according to structure, there are three varieties—hyaline cartilage, fibro-cartilage, and cellular cartilage.

Hyaline cartilage is best seen in the cartilage of the rib or in the trachea. A very fine section shows that the main mass is composed of a transparent, glassy material (the matrix), imbedded in which are rounded or oval cells, rarely arranged singly, but commonly in groups of two or more. Each cell shows a nucleus and one or more nucleoli. The cavity of the matrix in which the cells are imbedded is usually bounded by an ill-defined capsule of the same structure as the surrounding matrix.

When boiled with water for fifteen or twenty hours, cartilage is resolved into *chondrin.* This substance resembles gelatine in becoming jelly-like on cooling, but differs in being precipitated by the mineral and other acids, and by acetate of lead. No blood-vessels or nerves penetrate hyaline cartilage as a rule. Whatever nourishment it receives is derived by imbibition from the *perichondrium,* a fibrous membrane which invests all forms of cartilage except the articular. When cartilage exists in thick masses, as in the costal cartilages, canals are at wide intervals excavated in its substance, in which blood-vessels lie, and from which nutrient fluid exudes to the surrounding cartilage.

The main varieties of hyaline cartilage are costal, articular, and temporary. *Temporary cartilage* resembles in structure ordinary hyaline cartilage; but subsequently becomes changed into bone. In *costal cartilage* the matrix often shows a tendency to become somewhat fibrous.

In *articular cartilage* the cells are smaller than in costal, and more uniformly disposed. Near the surface the cells are flattened and parallel to it; nearer the bone they are arranged vertically. (Fig. 23.)

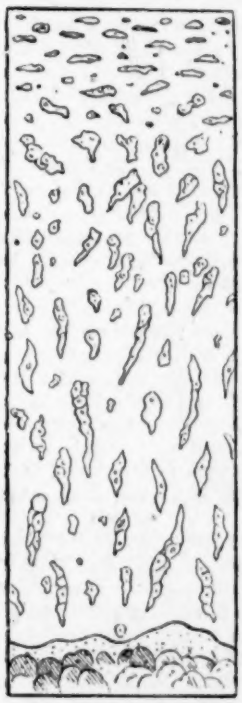


Fig. 23.—Vertical Section of Articular Cartilage.

Fibro-cartilage is found in two varieties, corresponding to the two varieties of fibrous tissue; white fibro-cartilage and yellow or elastic fibro-cartilage.

In *white fibro-cartilage,* the matrix is replaced by white fibrous-tissue, and there may be but few cells in

it. It combines the firmness and elasticity of hyaline cartilage with a greater amount of flexibility and toughness. In some cases it lies between the articular surfaces of bones, as in the lower-jaw; in others it forms a rim deepening articular cavities, as in the glenoid cavity; and it connects the bodies of the vertebræ together in the form of the inter-vertebral discs.

Yellow fibro-cartilage consists of cartilage cells imbedded in a matrix of elastic fibrous tissue. The character of the elastic tissue is shown by its resisting the action of acetic acid, unlike the white fibrous tissue. The cartilages of the external ear and of the Eustachian tube, of the epiglottis and cornicula of the larynx are composed of it.

Cellular cartilage is not found in man after birth, but exists as a fœtal structure in the chorda dorsalis, a structure around which the bodies of the future vertebræ are formed. The external ear of the rat consists of it. It differs from other forms of cartilage in having very little matrix.

Then we have the following varieties of cartilage:—

1. Temporary cartilage, which is hyaline.
2. Permanent cartilage
   - 1. Hyaline
     - 1. Articular.
     - 2. Costal.
   - 2. Fibro-cartilage
     - 1. Yellow fibro-cartilage.
     - 2. White " "
   - 3. Cellular (not in man).

Bone is a much more complex tissue than cartilage, and, unlike it, receives an abundant supply of blood. We will consider its chemical composition, structure, physical properties, and development.

(1) *Chemical composition.*—It consists of two parts most intimately combined—two-thirds or 66·7 per cent. earthy, and one-third or 33·3 per cent. animal matter. Of the 66·7 per cent. of earthy matter, 51 per cent. is phosphate of calcium, 11 per cent. carbonate of calcium, and 2 per cent. fluoride of calcium, with minute proportions of other salts. The animal matter which can be extracted from bone by boiling, or by steeping it in dilute hydrochloric acid (which separates the salts), becomes gelatine when it is boiled, a substance of which the main characteristics are that it solidifies on cooling, and on the addition of tannin forms a material identical with leather. The hides of cows contain a large amount of gelatine, and leather is usually made from them. By burning a bone in a bright red fire all the animal part is destroyed, and yet the shape of the bone remains; similarly when the salts are removed by hydrochloric acid the general shape of the bone is maintained; in the former case what is left is extremely brittle, and falls to pieces when touched; in the latter case it is extremely soft and flexible.

(2) *Structure.*—If you make a longitudinal section of a long bone, you will see that there appear to be two different kinds, *dense or compact* and *cancellous.* In a long bone the two ends consist of the latter, and the shaft of the former; but even at the ends there is a small shell of compact bone enclosing the cancellous. You will also note that the shaft is hollowed out in its interior, forming the *medullary cavity*, so-called because it contains the *medulla* or marrow, which consists chiefly of fat. The spaces of the cancellous bone are filled with a marrow differing from that of the shaft of the long bone, in not containing so many fat cells, in being more fluid, and of a redder colour, and in possessing cells very like the white blood corpuscles, and like them capable of amœboid movements, as well as a few larger and many nucleated cells (called *myeloid* cells).

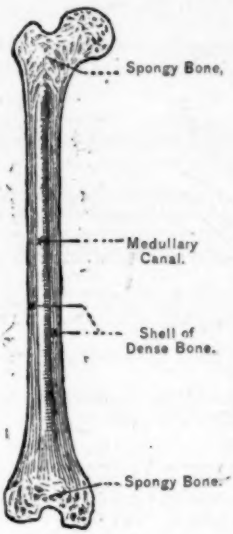


Fig. 24.—Longitudinal Section of Femur.

In the short bones, *e.g.*, the carpus and tarsus, there is a thin shell of compact bone, enclosing cancellous bone. The bones of the vault of the skull consist of a layer of cancellous bone, with compact bone on each side of it; and this structure is found to greatly diminish liability to injury of the brain.

The surface of all bones, except where they are covered by articular cartilage, is clothed with a tough fibrous membrane, the periosteum (*peri*, about, *osteon*, bone), which consists of two layers, an outer of white fibres and a few fat cells, and an inner layer of elastic fibres. It is extremely vascular, and from it blood-vessels enter the bone and nourish it. When any part of the periosteum is seriously injured, the bone beneath it will almost certainly die.

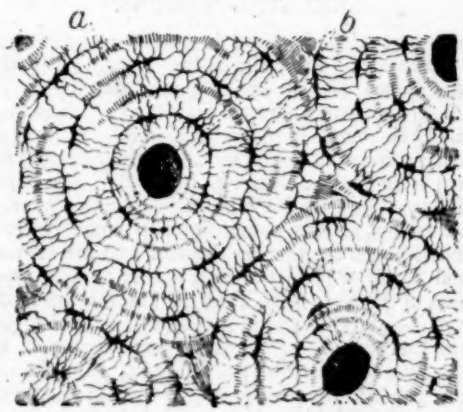


Fig. 25.—Transverse Section of Compact Bone (much magnified).
(*a*) Haversian Canal. (*b*) Lacunæ and Canaliculi.

The compact bone seems to differ from the cancellous, in having hardly any pores in it; but if examined with a magnifying glass, it will be found to be everywhere porous, the only difference being that

the pores in compact bone are much smaller than in cancellous. A transverse section of compact bone will show something like what is represented in Fig. 25. It is studded all over with minute spaces, called *lacunæ*, not larger than a white blood corpuscle, each lacuna having minute canals, called *canaliculi*, running from it to neighbouring lacunæ. These lacunæ and canaliculi are seen to be arranged concentrically around a large canal, called a *Haversian canal*, which is about $\frac{1}{500}$ of an inch in diameter, and contains one or more minute blood-vessels, and often a minute twig of a nerve. The distance between individual Haversian canals is $\frac{1}{250}$ to $\frac{1}{70}$ inch. In cancellous bone, the spaces between the cancellæ of the bone replace the Haversian canals of compact bone.

The lacunæ are occupied by protoplasmic nucleated cells, very similar to connective-tissue corpuscles, and like them presenting branches which enter the canaliculi, and probably join the branches from the cells of other lacunæ. These cells carry the nourishment received by imbibition from the blood in the Haversian canals, to every part of the bone.

This is the canal system of bones, consisting of a free communication between Haversian canals and lacunæ by means of canaliculi. The spaces between these cavities are occupied by the proper bone tissue. The ultimate structure of the bone tissue seems to be reticular; very delicate fibres arranged as in a network, these being penetrated by other fibres which bind the neighbouring lamellæ together.

(3). *Physical Properties.*—Bone when examined out of the body is almost white, but in the living condition it is pink, from the number of blood-vessels it contains. It is very hard, but also possesses a considerable amount of elasticity, which is increased by the curved shapes so common in bones. On examining the femur, for example, we find that it presents an anterior convexity, and that the upper end is obliquely attached. In order to still further strengthen it, a dense ridge of bone runs down its posterior surface. The direction of the fibres of cancellous tissue is always found exactly arranged so that they are at right angles to the direction in which pressure is usually exerted. Where lightness of bone is required we find cancellous tissue, and in birds there are large cavities containing air, which considerably increase their buoyancy.

(4). *Development* of bone occurs in two different ways. In one it occurs *in membrane*, a sort of connective tissue, in the other *in cartilage*.

Bones are not entirely ossified at birth, but ossification has begun at certain points, called *centres of ossification*, from which points it gradually extends. Thus, in a long bone like the femur, there are three main centres of ossification, one in the centre of the shaft (called the *diaphysis*), and one at each end (called an *epiphysis*). The actual increase in length of a long bone is owing to a rapid multiplication of the cartilage cells lying between the three centres of ossification, and growth ceases when, the formation of bone being more rapid than that of the softer structures, it becomes impregnated throughout with calcareous salts.

In the development of bone in cartilage the following processes may be recognised:—(1) The cartilage cells become elongated and collected into rows. (2) Between the rows of cells earthy matter is deposited; thus calcified cartilage is formed. (3) Vessels run in between the rows of cartilage cells; and (4) osteoblasts, which are nucleated masses of protoplasm, encroach on the earthy matrix, hollowing it out into large cavities. We may compare their action to that of an amœba absorbing its food. (5) True bone is formed in the hollow spaces thus produced by the deposit of concentric laminæ of osseous matter.

Putting it shortly, we may say that cartilage is calcified, and then tunnels are driven in this, and in these true bone is formed by the centripetal formation of successive layers.

When bone is developed from fibrous tissue, there is no preliminary deposit of calcareous matter, but bone is laid down at once in spaces formed by absorption.

Ossification in membrane occurs especially in the bones of the skull; the long bones are formed in cartilage. But even in the latter, the original bone formed from cartilage becomes thickened by a deposit of bone on its exterior, formed from the periosteum (and therefore from membrane); the original bone becoming to a large extent absorbed to form the medullary canal. So that the amount of ossification in cartilage is less than at first sight appears.

Practical Work.—1. To examine cartilage, take a piece of rib cartilage from a rabbit, and with a sharp razor cut a very thin section from it. Mount in glycerine and examine. Articular cartilage may be obtained for examination from the end of a bone softened by hydrochloric acid, and elastic cartilage from the epiglottis (uppermost part of the larynx) of a sheep.

2. Soften a piece of a long bone in hydrochloric acid; then wash with water to free from the acid, and after cutting a very thin section, examine for the appearances in Fig. 25. Unsoftened bone may be examined under the microscope, after cutting a thin piece with a fine saw, and then grinding still thinner on a hone.

3. Burn one piece of bone in the fire, and soften another piece by means of hydrochloric acid, and then tie it in a knot to show the flexibility it now possesses.

4. Developing bone may be examined in a kitten after drowning. Remove one of the long bones; in its centre will be found a piece in which ossification has begun. Cut the whole bone longitudinally, and then make thin sections at junction of cartilage with new bone, so as to show the appearances of both.

(To be continued.)

THE METEOROLOGICAL STATION ON BEN NEVIS.—This mountain, though so difficult to climb in bad weather, has long been deemed an exceptionally favourable site from which to take meteorological observations. It is the highest point of the British Isles, and stands by the seashore on the west coast of Scotland. Springing as it does directly from the water-level, its full height and exposed situation can be properly appreciated. For some time past an observatory has been in process of erection on its summit, and it is now understood that this is likely to be finished before the close of the year. The road to the top of the mountain is already about half finished, and sufficient shelter for three observers will be provided before the end of November. The regular observations are calculated to begin on November 1.

SUMMER SONG.

T. CRAMPTON.

Gracioso. mf
1st TREBLE.
2nd TREBLE.
BASS.
1. Thro' the lawn and groves be - fore us, Let us wan - der blithe and gay;
2. Come and pluck the beau-teous flowers That shine in glad - ness all a - round;
KEY B♭. Gracioso. mf
We will sing a joy - ful cho - rus On our plea - sant way. Rug - ged or smooth the
Swell - ing from yon sha - dy bowers We hear a charm - ing sound. Hap - py and free each
F. t.
f. B♭.
path may be, Fierce glow the sunbeams—what care we?
youth - ful heart Wel-comes with mirth his joy - ful part.
Flowers and birds this sum - mer day,
Flowers and birds this sum - mer day,
Smile a wel-come, Smile a wel - come
Smile a - wel - come where we stray,
where we stray, Smile a wel - come where we stray.
Symph.
Symph.

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Lessons in Latin.

BY THE REV. A. D. CAPEL, M.A., CANTAB.,

Formerly Examiner of Schools to Cambridge Local Examinations Syndicate.

KEY TO EXERCISES.

EXERCISE 28.

A.

1. The boy who learnt his lessons is praised by his master. 2. They will be loved who have perished for their country. 3. The powers which (are) in heaven will be shaken. 4. A great triumph was being given to Camillus, who had conquered many enemies of the Romans. 5. Manlius, who killed a Gaul in a contest, and took a ring from his finger, received the surname of Torquatus. 6. The boy is being led to the tree, that he may be beaten there. 7. The matter is being well waged (Eng. managed) by the consul. 8. The breath which we draw is given to men by God. 9. The farmer has planted a tree, the fruits of which he will never see. 10. They have not found their son, for whom they had bought the bread.

B.

1. Pater, qui filios suos bene docet, a cunctis laudatur. 2. Mater, cujus filiæ male docentur, misera est. 3. Viris laborandum est, et mulieribus flendum est. 4. Nonne cunctis ambulandum est sub jugum, quod erigitur. 5. Puer, qui verberatur non præsenti magistrum amat. 6. Vallis implebitur et mons imminuetur. 7. Amo audire de heroibus qui pro patria perierunt. 8. Nemo, regum temporibus, urbem Romam cepit, sed a Coriolano proditore pæne capiebatur. 9. Coriolani uxor et mater fletu et deprecatione urbem solum conservaverunt. 10. Omnes boni a civibus suis amantur.

LESSON XXIX.

ADJECTIVES OF I DECLENSION.

224. Adjectives of the I form have only one form for all genders, except in the nom., voc., and acc. in both numbers, when the neut. has a separate form.

225. If the gen. pl., either regularly or irregularly, ends in 'ium,' the neut. of the N. V. and acc. plural ends in 'ia' ('plura,' instead of 'pluria,' being the only exception).

226. The neut. N. V. and Acc. of I adjectives in 'is' ends in 'e.'

227. If the neut. nom. end in 'e,' the ab. sing. ends in 'i,' otherwise it sometimes ends in 'e' and sometimes in 'i.'

228. Some I adjectives have three forms in the nom. sing., and some have only one, but in all cases the whole nom. will be given in the vocabularies.

229. An I adjective, then, is thus declined:—

	Sing.	
N. V.	Tristis	Triste
Ac.	Tristem	Triste
G.	Tristis	
D. Ab.	Tristi	
	Plural.	
N. V. A.	Tristes	Tristia
G.	Tristium	
D. Ab.	Tristibus	

230. VOCABULARY 29.

Eng.	*Lat.*		*Derivative.*
They are	Sunt (pl. of est)		
	m. f. *n.*		
Disgraceful	Turpis Turpe	R. Turp	Turpitude
All	Omnis Omne	R. Omn	Omnipotent
Immediate / Instant	Instans	R. Instant	Instantaneous
Brave	Fortis Forte	R. Fort	Fortitude
Great / Huge	Ingens.	R. Ingent	
Rich	Dives (adj.)	R. Div	
Easy	Făcĭlis Facile	R. Facil	Facilitate

Sweet	Dulcis Dulce	R. Dulc	Dulcet
On account of	Ob, prep. gov. acc. case		
Dictator	Dictator	G. Dictatoris	
To condemn	Damnare	R. Damn	Damnation
Favour	Favor	G. Favōris	Favorite
At / At the house of	Apud, prep. gov. acc. case		
Disgrace	Dēdĕcus	G. Dedecŏris	
Wealth	Opes (used in pl.)	G. S. Opis	Opulent
Deservedly	Mĕrĭtō, an adverb		
Chest	Arca	G. Arcæ	Arcana
True	Vĕrus -ra -rum	R. Ver	Veracious
Envied	Invīsus -sa -sum	R. Invis	
To promise	Prōmittĕre	P. R. Promīs	
Night	Nox	G. Noctis	Nocturnal
To intercept / To take from between ... ... / To go in between	Intercĭpĕre	P. R. Intercēp	Interception
To receive	Rĕcĭpĕre	P. R. Recēp	Reception
Statue	Stătua	G. Statuæ	
To place	Pōnĕre	P. R. Posu	Position
Stag	Cervus	G. Cervi	
Captive	Captīvus	G. Captivi	Captivate
To restore	Reddĕre	P. R. Reddid	
Destruction	Nex	G. Nĕcis	
To order	Jŭbĕre	P. R. Juss	
Physician	Mĕdĭcus	G. Medici	Medical

EXERCISE 29.

A.

1. Turpe est fidem (10) violare (17). 2. Facile est fidem (10) servare (10). 3. Omnes viri (18) a filiis (7) amantur (2). 4. Omnibus hominibus (5) laborandum est (13). 5. Ob quam rem (13) a dictatore capitis (11) (Eng., to death) damnatur; sed (6) ingenti favore militum (6) liberatur (12). 6. Samnites (26) Romanos (20) apud Caudinas Furculas (Eng., Caudine Forks) ingenti dedecore vicerunt (23) et sub (8) jugum (28) miserunt (5). 7. Opes invisæ merito sunt forti viro (18) quia (7) dives arca veram laudem (22) intercipit. 8. Tristem recepi epistolam (7) quam ad me (Eng., me) scripsisti (4). 9. Romulo (19) ingentem statuam posuerunt Romani(20). 10. Cervus venatorum (27) fugit (27) instantem necem.

B.

1. It is easy to write (4) a letter (7). 2. The Africans (26) placed (Eng., raised) a huge statue to Hannibal (26). 3. A sad death (8) is being told (15) by the soldier (6). 4. All the men (5) are being sent (5) under (8) the yoke (28). 5. It is sweet to lie (13) on the grass (18) in summer (16). 6. Pyrrhus, whom the consul (17) wounded (17) with his own (20) hand (8), fled (27) to Tarentum (Lat., same word). 7. Then (20) the Romans (20) ordered all the captives, whom Pyrrhus had restored, to return (27). 8. The physician of Valerius (Lat., same word, 'o' decl.) came (19) to Fabricius (Lat., same word, 'o' decl.) by night and promised to kill him (Lat., eum). 9. Hiero (Lat., same word; G., Hieronis) with (20) all the men (18) asked peace of (Lat., 'a' with ab) the Romans. 10. We must fight (10) bravely (26) for (28) our country (10).

LESSON XXX.

FIRST PERSONS PASSIVE.

232. The Latin for I at the end of a passive verb formed with a present root, ends in 'r.'

233. This 'r' is added on to the corresponding active forms that end in 'o,' as 'amabo,' 'I shall love;' 'amabor,' 'I shall be loved.'

234. In those active forms, which end in 'm,' the 'm' is changed into 'r,' as 'audirem,' 'I might hear'; 'audirer,' 'I might be heard.'

235. The Latin for 'we,' at end of passive verbs, formed with present roots is 'mur,' formed from 'mus' (the active form) by changing the 's' into 'r': so that of the six forms of a passive tense, four end in the letter 'r.'

236. VOCABULARY 30.

English.	*Latin.*		*Derivative.*
To sing of	Cănĕre	P. R. Cĕcĭn	Chant
To advise	Mŏnere	P. R. Monu	Admonition
Mild / Gentle	*m. f. n.* Mī -tis, Mite	R. Mit	Mitigate
Therefore	Igĭtur, a conj.		
To butcher	Trŭcidare	R. Trucid	
To run	Currĕre	P. R. Cucurr	Current
Tempest / Storm	Tempestas	Tempestātis	Tempestuous
To destroy	Obruĕre	P. R. Obru	
To examine	Interrŏgare	R. Interrŏg	Interrogation
	m. f. n.		
Who or what (?)	Quis, Quæ, Quid, dec. like qui (Par. 214).		
To handle	Tractare	R. Tract	Tractable
To arrive	Pervĕnire	P. R. Pervēn	
Within	Intra, prep. gov. acc. case.		
Shore	Littus	G. Littoris, n. g.	
Troy	Trōja	G. Trojæ	Trojan
Mouth	Os	G. Oris, n. g.	Oral
With impunity	Impune, an adv.		
To kill	Occīdere	P. R. Occīd	
Zeal	Studium	G. Studii, n. g.	Study

237. EXERCISE 30.

A.

1. A Deo (27) amamur (2). 2. Moneor ne (Lat. for 'ut non') ad aquam (7) descendam (14). 3. Miti a regina (8) regimur (4) igitur pro (28) patriâ (10) pugnemus (10). 4. Nos (Eng. we) qui patriam (10) amavimus (2) a civibus (8) trucidamur. 5. Ego (Eng. I) qui matrem (14) servavi (10) a fratribus (14) occidar (4) (see 107). 6. Laborandum (13) est ut opus (13) conficiatur (26). 7. Bonis (20) a magistris (13) docemur (3) igitur discamus (27) (see par. 53). 8. Consules (17) ingentibus (29) prælĭis (26) Samnites (26) confecerunt (26). 9. Currendum est ne tempestate obruamur. 10. Cis (12) Alpes (12) vivamus (6) ne ab hostibus (10) vexemur (15).

B.

(Notice in A. the position of a prep. when governing a noun and an adj., and imitate).

1. We were being conquered (23) by the Samnites (26) when (13) the Dictator (29) arrived. 2. We must learn (27) that we may be praised (2) by (our) master (13). 3. It is pleasant (21) to live (6) when (13) we are loved (2) by all (29). 4. Who loves (2) us (nos) when (13) we are being vexed (15) except (17) (our) parents (11). 5. The town (7) is large (20), we shall not be found (28) within (its) walls (9). 6. The general (2) said (15) to his (20) soldiers (6) we must fight (10), not fly (27). 7. The soldiers (6) said (15) we will not fly (27). 8. Afterwards (16) we were being led (9) to the king (8) that we might be examined. 9. I sing of the man (18) who first (20)

came (19) from (Lat. a) the shores of Troy to Italy (20). 10. Mouths of lions (13) are with impunity handled by their schoolmasters (13) (Eng. keepers).

LESSON XXXI.

IRREGULAR ADJECTIVES IN US.

238. Some few very common adjectives, as well as the adjective pronouns, retain the old forms 'ius' and 'i' in the gen. and dat. sing. respectively.

239. These adjectives and no others are all given in the following vocabulary.

240. The genitive and dative of 'alius' ought to 'aliius' and 'alii' respectively, but these words are contracted into alius and ali; where the 'i' is exceptionally long.

242. VOCABULARY 31.

English. *Sing.*	*Latin.* *m. f. n.*		*Derivative.*
One	Unus -na -num	R. Un.	Unit
Any	Ullus -la -lum	R. Ull.	
None	Nullus -la -lum	R. Null.	Nullify
Which of two / Either of two	Uter -tra -trum	R. Utr.	
The other of two	Alter -era -erum	R. Alter	Alternate
Neither of two	Neuter -tra -trum	R. Neutr	Neutral
Another	Alius -ia -iud	R. Ali	Alias
One thing—another	Aliud—aliud		
Some—others	Alii—alii		
To drown	Mergere	P. R. Mers	Immerse
From	A or ab		Absent
Conqueror	Victor	G. Victoris	Victorious
To depart	Discessere	P. R. Discess	
Again	Rursus, an adv.		
To besiege	Oppugnare	R. Oppugn	
Nothing	Nihil (indec.) n.g.		Annihilate
Ancestors	Mājōres (plur.)	R. Major	Majority
Sorrow	Dŏlor	G. Dolōris	Dolorous
Without	Sine, prep. gov. ab. case		
To do	Făcĕre	P. R. Fēc	Factory
To flow	Fluo	P. R. Flux	Fluctuate

243. EXERCISE 31.

A.

1. Unus est Romanus (20) alter Albanus (Eng. Alban). 2. Romanorum alii morbo (26) peribant (26), alii in flumine (5) mergebantur. 3. Albanorum fratrum (14) nullus servabatur (10) sed (6) Romanorum fratrum unus a prælio (26) victor discedebat. 4. Parentum (11) meorum (20) neuter vivit (6). 5. Aliud est discere (27) aliud docere (3). 6. Utram amas (2)? 7. Is (Eng. he) verus (29) est amicus (5), qui alios oppressos (Eng. oppressed) amat (2). 8. Aliis nunc (27) pugnandum (10) est, cras (15) rursus pugnandum est. 9. Nihil ulli fecit. 10. Nemo (17) est nullius filius, (7) omnes (29) parentes (11) habent (7).

B.

1. Some are great (20), some small (20). 2. A man (5) is the son (7) of one father (14) and one mother (14), but (6) he has (7) many (20) ancestors. 3. Who (30) sees (27) sorrow without mourning (20)? 4. One of (26) the boys (7) ran (26) through the town (7), the other lay (13) on the grass (18). 5. All (29) the boys (7) were being drowned in the river (5), when (13) their (20) father (14) saved (10) them (Lat. eos). 6. It is one thing to seek (9), another to have (7). 7. The mouths (30) of the boys are filled (12) with food (12). 8. I shall not give (12) (to) the boy the books (6) of either of his two friends (5). 9. The boys will work (12) for one master (13) whom they love (2), but (6) not for the other who is severe (Lat. severus). 10. Let us all (29) learn (27) to fight (10) for (28) our country (10) that we may have (7) peace (9).

LESSON XXXII.

RECAPITULATORY.

244. EXERCISE 32.

A.

1. Multas (20) res (13) fecisti (31) quæ matrem (14) lædunt. 2. Amnis (18) qui in oceanum (Eng., ocean) fluit (31), magnus (20) est. 3. Nonne omnibus (29) pueris (7) interdum (23) ludendum (12) est. 4. Dominus (9) qui servum (7) occidit (30) cras (15) trucidabitur (30). 5. Milites (6) Cæsaris temporibus (17) hieme (11) non pugnabant (10). 6. Dictata (12) omni (29) studio (30) discamus (27). 7. Cum (20) Tuscis (Eng., Tuscans) pacem (9) fecit (31) et templum (17) Jovi (Eng. to Jupiter) ædificavit (17). 8. Mox (20) exercitus (19) quoque (20) Tarquinium, qui urbem (7) Ardeam (Eng., Ardea) cum (20) rege (8) oppugnabat, (31) reliquit (26). 9. Post (17) quatuor (23) annos (17) Afri (26) rebellaverunt (17). 10. Facile (29) est currere (26) per prata (11).

B.

1. The great (20) snake (19) crept (19) through the wall (9). 2. I have learnt (27) my (20) lessons (12). 3. It is natural to man (21) to bury (15) his (20) children (11) near (9) (his) city (7). 4. Cæsar conquered (23) his (20) enemies (10). 5. He ordered (29) Fabius (Lat. Fabius 'o' decl.) that he should not (18) fight (10). 6. He hears (4) the high (20) (Eng. loud) shouts (13) of the enemy (10). 7. He placed (29) (Eng. raised) a huge (29) statue (29) to Hannibal (26). 8. He built (17) many (20) and large (20) temples (17) on the Capitol (17). 9. In the autumn (16) we reap (12) the harvest (7) of the year (17). 10. You have teased (15) your (20) sister (8).

EXAMINATION QUESTION NO. 4.

1. Explain clearly the nature of a relative. 2. What is a cæsura? 3. Where in an Hexameter line must you be careful to have no cæsura? 4. How is the Passive voice generally formed from the Active? 5. When does the Abl. sing. of I adjectives end in 'i.' 6. Distinguish between the 'of's in the following sentences, and state how you would translate them into Latin:—

(*a*) The son of Cæsar, etc.
(*b*) One of them ran away.
(*c*) I am thinking of my mother.
(*d*) He said it of me.
(*e*) He took the city of Rome.

(To be continued.)

Anecdotal Natural History.

BY THE REV. J. G. WOOD, M.A., F.L.S.,
Author of 'Homes without Hands,' 'Nature's Teachings,' etc.,
AND THEODORE WOOD,
Joint Author of 'The Field Naturalist's Handbook.'

No. XXIV.—THE EDENTATA.

ONE of the most remarkable groups of mammals is that comprising the animals known as EDENTATA (*i.e.*, 'toothless'), from the fact that the incisor teeth are invariably wanting. Owing to the nature of the food of these animals these teeth are not required, and, indeed, if present, would be more of a hindrance than a help during the process of feeding.

In many of the edentata teeth are entirely wanting in both jaws. In others, however, a small number of molars are present, although in a modified form, being quite rootless, and also without the facing of enamel which is so important an element in the teeth of other animals. All the members of this group are furnished with stout and strong claws, and almost all are slow and cautious in their movements.

As our first type of the extraordinary genus of *Manis* we will take the Phatagin, or Long-tailed Manis (*Manis tetradactyla*), a native of Western Africa, and one of the most curious of this strange group of animals.

It is a tolerably large species, averaging about five feet in total length, of which, however, more than half is occupied by the tail. With the exception of the head, the entire body is clothed in a kind of scale armour, consisting of a large number of horny plates, which overlap each other in such a manner that the animal is effectually protected from almost any enemy. Nor do these scales form a defensive weapon alone, for they are so sharply edged and acutely pointed that they can inflict very painful wounds upon any foe who is rash enough to venture upon open attack. Capturing a phatagin, indeed, is a most difficult business, for the head, which is almost the only vulnerable part, is so hidden away beneath the body as to be quite secure from injury, while the horny plates with which the body is clothed can bid defiance to any foe.

The food of the phatagin consists of many insects, and chiefly of the termites, or white ants, as they are often but wrongly termed, whose lofty nests are sometimes of such surprising dimensions. These nests, strong though they are, however, form no obstacle to the hungry phatagin, which tears away the walls with its powerful claws, and licks up the inmates by means of its extensible tongue. This tongue is lubricated with a glutinous fluid, which prevents the inmates from escaping before they are taken into the mouth.

The claws are also employed by the phatagin in excavating subterranean burrows for purposes of habitation, the powerful talons tearing up the soil with wonderful rapidity.

THE reader will probably have noticed that the same type of animal is represented in different parts of the globe, and that even in Australia, where the marsupialism divides the native mammals from those of the Old World, there is still a shadow, so to speak, of the same type.

Thus, the Petaurists of Australia represent the Flying Squirrels of Asia, the Kangaroo Rat almost exactly resembles the Jerboas, the Thylacinus repeats in shape and character the Wolf of the Old World—and so forth.

The Phatagin of Africa finds in Asia its double in the PANGOLIN or BAJJERKEIT (*Manis pentadactyla*). Except that the tail is barely half the comparative length of that of the phatagin, one Manis might easily be mistaken for the other.

Among some of the semi-savage Asiatic tribes, the warriors take advantage of the extremely hard and practically impenetrable armour of the pangolin to construct cuirasses which are impenetrable to any weapon except firearms, and which will even turn a rifle bullet if it should strike in the least on one side.

One of my friends, who passed many years in India, and who has always been enthusiastically fond of natural history, procured a pangolin, hoping to study its habits.

Unfortunately, the only habit which it exhibited was that of digging burrows and hiding itself in them. The creature was also perpetually escaping by digging holes under the walls of the enclosure.

Then he paved a small yard with large stones and put the pangolin into it. The powerful muscles and enormous claws of the pangolin made short work of the stones, and no pavement which he could lay was proof against the tremendous burrowing powers of the animal.

Finding that he could not retain the animal, he determined to kill it, and, in order that it should not suffer needless pain, he took the office of executioner on himself.

So he armed himself with a Colt's revolver, and, having managed to get a fair shot at its side, he fired at the heart from the distance of four or five feet. The pangolin was knocked over by the force of the conical bullet, and driven to the further end of the yard, where it lay perfectly still, but rolled up after the fashion of its kind.

Finding that the animal was not dead, nor, indeed, had suffered any apparent injury, he fired two more shots at it. The first merely sent the pangolin rolling over the ground as before, and the third bullet, which happened to strike fair, instead of glancing off the scales as the others had done, recoiled and struck the intended executioner in the face.

At last, the owner of the pangolin bethought himself of a very strong and sharp Indian dagger which he possessed. So he introduced the point of the dagger between the scales, directing it towards the heart, and then drove it nearly through the animal by blows from a mallet.

He preserved the skin and kindly gave it to me. From the exterior no wound is perceptible, the only trace of the attacks upon it being that when the spots where the bullets had struck were very carefully examined, some slight streaks of lead might be detected. On the inside, the wound made by the dagger was plainly to be seen.

The pangolin is not only a good burrower, but is capable of climbing trees in search of insect prey.

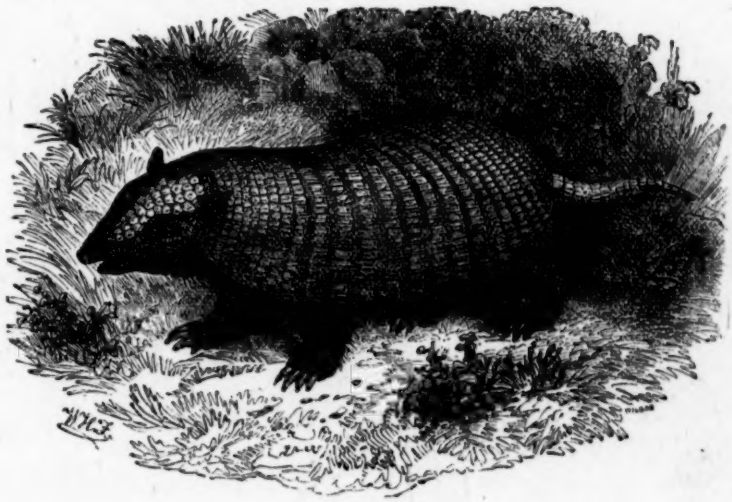
LESS striking in appearance, although armed in a somewhat similar manner, the Armadillos next claim our attention. As the habits of all these creatures are of much the same nature, we will take one species only as a type of the remainder.

This type shall be the common armadillo, or Poyou

(*Dasypus sexcinctus*) of Paraguay, where it is tolerably plentiful, its agility, however, causing it to be far more often seen than captured.

Just as the phatagin is clothed in a kind of natural scale armour, so the armadillos are furnished with a protective covering resembling the plate-armour of the middle ages. This covering consists of three large horny plates, one being placed upon the head, a second upon the shoulders, and a third upon the hinder quarters. These plates are connected by means of a number of rings, almost bony in their structure, which serve the double purpose of protecting the otherwise uncovered portions of the body, and of allowing considerable freedom of motion to the animal in spite of the rigidity of its armature.

It must not be thought, however, that the three large plates which form the basis of this armour are formed in a single piece, for each is constructed of a large number of small plates which form a kind of pattern, differing somewhat in the various species. These plates extend over the whole of the tail, and also over the lower portion of the legs, the upper parts being sheltered under the armature of the body, and so requiring no further protection.



The Armadillo.

Like the manis, the armadillo is a burrowing animal, and excavates tunnels of such depth that it can only be ejected by means of severe and prolonged labour. Unlike most of the Edentata it is very quick in its movements, and can run with such rapidity that even an active man can scarcely overtake it. In a menagerie, I have seen it run with considerable speed, though a playful monkey had seated himself on its back.

The armadillo is a nocturnal animal, remaining during the daytime securely hidden away in its burrow. After dark it sallies forth in search of food, which, in consequence of the mixed nature of its diet, it generally finds without difficulty. Roots, grain, fruit, worms, insects, offal, and various other substances furnish the armadillo with a meal, one of these animals, the Giant Armadillo of Brazil, even exhuming corpses from their graves, and feeding eagerly upon the remains.

Although the armour of the armadillos is not furnished with the keen edges and points which render the scales of the phatagin so effective a weapon of offence as well as of defence, these animals are scarcely less difficult to capture, for, putting upon one side their activity, and also the almost total impossibility of wounding them, when brought to bay, they can fight very fiercely if need be, their long, pointed claws being capable of inflicting really serious wounds upon the person of their would-be captor. Bold, indeed, would be the man who should essay to take prisoner a giant armadillo without providing himself with some special means of protection, and very unlikely would he be to bring the undertaking to a successful issue.

THE Aard-Vark, or Earth-hog, of Southern Africa (*Orycteropus Capensis*), deserves a few words of passing mention, if only for its services in keeping down the numbers of the ants upon which it preys. In order to suit it for its mode of life its claws are remarkably large and strong, the animal actually being able to dig faster by means of its talons than can a powerful man armed with a spade.

The aard-vark seldom ventures forth by day, making its raids upon the ants only after darkness has fairly set in. Just as is the case with the phatagin, the saliva is of a very glutinous consistency, and prevents the escape of the insects as they are being conveyed to the mouth by the long extensile tongue.

The aard-vark is not provided with armour of any kind like the previously described animals, being covered merely with bristly hairs. In length it is about five feet, of which the tail occupies some eighteen or twenty inches.

ONE of the largest animals of this group is the Ant-bear, or Great Ant-eater (*Myrmecophaga jubata*), which is a native of tropical America. The chief points of interest in this remarkable animal lie in the wonderfully elongate head, and the thick bushy plume of hairs which decorates the hinder portions of the body. It is rather a large creature, sometimes measuring as much as seven feet in total length.

The structure of the fore-paws is rather curious. As is the case with all the members of the group, the claws are long and powerful, in order to suit them for the office of tearing down the nests of the ants upon

which the animal feeds. In the ant-bear, however, they are so large as to render walking almost impossible when they are fully extended, the animal therefore folding them, when not in use, upon a kind of pad found upon the lower surface of the foot. This, however, renders it impossible for the foot to be placed flat upon the ground, so that the gait of the animal is peculiarly awkward and ungainly, and, in fact, is nothing but a scramble.

THE habits of the Little Ant-eater (*Cyclothurus didactylus*) are very different from those of its larger relative, for it is a native of trees, its structure being somewhat modified in order to suit it for an arboreal existence. The tail, for instance, is prehensile, the lower surface of the terminal portion being devoid of hair, and the member being possessed of sufficient muscular power to enable it to sustain the entire weight of the animal as it hangs from a branch. The paws are rather dissimilar in structure, the front pair being furnished with two claws only, while the hinder are provided with four.

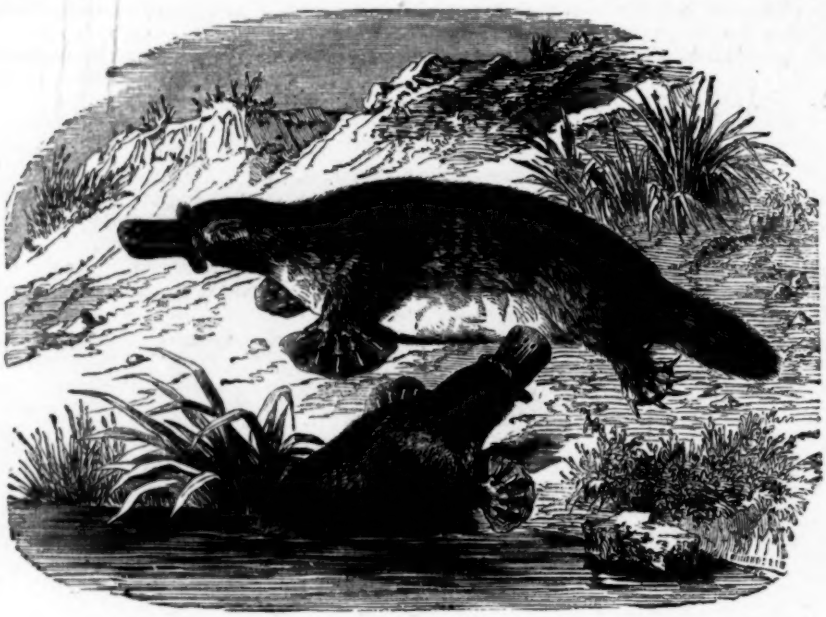
This ant-eater, which, like the preceding animal, is a native of tropical America, feeds upon the various insects to be found upon trees, its long narrow tongue enabling it to extract them from the crevices in which they have taken refuge. It also preys upon wasps, extracting the grubs from the nests in spite of the poisonous stings of the guardians.

STILL wrapped in mystery as regards many details of its life-history, the Duckbill, Platypus, or Mullingong of Australia (*Platypus anatinus*), has perhaps attracted more attention than any other animal, its singular structure and habits being so dissimilar to those of all other known mammals, that we can scarcely wonder that the whole scientific world was long undecided as to its true position in the animal kingdom.

The accompanying illustration will give a better idea of its general appearance than can possibly be conveyed by mere description, the webbed paws and the extraordinary beak being the most prominent features in its organization.

The true appearance of the latter organ cannot even be guessed at by means of even the most careful examination of a stuffed specimen. The black, shrivelled leathery aspect of the beak in a mounted skin is as unlike the true form as can well be the case, no trace remaining of the soft, delicate, pinky skin, mottled at the tip with a number of darker spots. The true nature of the appendage may be inferred from the fact that it is abundantly supplied with sensitive nerves, and that it is used as an organ of touch in the capture of prey.

The beak is formed by a curious development of the inter-maxillary bones, which are greatly elongated and flattened, with their ends turned rather inwards, so as to form a kind of hook. The lower jaw is also lengthened and flattened in a similar manner, although in a less degree, both being covered with a hairless skin.



The Platypus.

The duckbill is as nearly amphibious as an animal can well be, seeming equally at ease both in the water and upon dry land. In order to allow it to exist under conditions so opposite, its structure is curiously modified.

In the first place, the short, glossy, almost upright fur of the body affords no obstacle to its progress either through the water or through its subterranean burrows, even the mole itself being but little more favoured in this respect.

The diameter of the hairs, too, is far less at the base than at the tip, so that they can be bent in any required direction with the greatest possible ease. A similar structure is found in the mole.

Then, the paws are formed both for swimming and for digging, the toes being webbed for a considerable part of their length, more especially upon the front

feet, and furnished also with long curved claws, which can scratch away the soil with great rapidity. While digging, the webbed portion of the foot serves as a shovel to clear away the loosened earth.

So useful are the feet for this latter purpose that the burrow of the animal has often been known to extend to the distance of forty or fifty feet, and that, moreover, in a soil of a hard and gravelly consistency.

Upon the hinder feet of the male duckbill is found a perforated spur, about an inch in length, and connected with a gland situated near the ankle. It was formerly thought that this gland secreted poison, which was conveyed into any wound made by the spur just as is the venom through the fang of a serpent; but this theory has been effectually disproved by Dr. Bennett's well-known experiments.

In order to protect the ears from injury while the animal is submerged, the aperture is extremely small, and can be closed at will. The reader will at once be reminded of a similar structure in the case of the animals of the seal tribe, described in a former paper of this series.

It is worthy of note that the skin of the duckbill is peculiarly loose; so much so, indeed, that it is far from easy to retain the animal in the grasp. The same structure, too, preserves it from many an injury, a gunshot wound, even, unless at very close quarters, producing but little effect upon the animal.

The food of the duckbill is of an animal nature, and consists of worms, water insects, and small molluscs. The latter it crushes by means of the curious substitutes for teeth with which the mouth is provided, these consisting of four horny, channelled plates, two of which are found in each jaw.

At the very extremity of the burrow is formed a kind of clumsy nest, consisting generally of a quantity of dried herbage piled loosely together. In this nest the young are brought up. The little creatures when first born are remarkably unlike their parents, being quite naked, with short flexible beaks, and not showing signs of an incipient coat for some little time.

It is a rather curious fact that the fur of the duckbill, when the animal is in health, is not affected by water, throwing it off, indeed, just as does the proverbial duck's back. Should, however, the creature be weak, sickly, or wounded, the coat seems at once to lose this power, becoming wet and draggled, and causing the animal to sink.

WE now come to a group of beings quite as extraordinary in their way as the duckbill, their mode of life being absolutely unique in the animal world. These are the Sloths, concerning which so much misconception existed until Waterton investigated their life-history, and proved that the current theories as to their habits were totally at variance with facts.

All previous writers had based their statements upon observations taken when the animals were placed upon a level surface, forgetting, or rather not recognising the fact, that a sloth upon the ground is as much out of place as would be a buffalo in a tree. Formed by nature expressly for an arboreal life, the motions of the sloth were naturally awkward and ungainly when placed under conditions so different from those to which it was accustomed; but to therefore suppose that in its wild state the animal led a life of misery was a notion so absurd that it is surprising that it was ever entertained.

The mode of existence for which the sloth is so admirably suited is different from that of all other animals, for it spends the whole of its existence suspended, with its back downwards, from the branches of trees, upon the leaves of which it feeds. As Sydney Smith wittily said, it moves suspended, rests suspended, sleeps suspended, and passes its whole life in suspense, like a young clergyman distantly related to a bishop.

In order to enable it to retain its hold upon the bough, the claws of the sloth are strongly curved, and the legs are gifted with enormous muscular power, fatigue literally seeming to be a thing unknown to them.

It was formerly thought that the sloth remained upon one tree until he had stripped it of its leaves, when he rolled himself into a ball and fell to the ground, then crawling painfully to another tree. Waterton, however, discovered that the animal is seldom at rest, and travels for long distances through the forest. Windy weather seems most suitable for its peregrinations, as the branches of the trees are then blown closely together, so that the sloth can pass from one to the other without difficulty.

The Two-toed Sloth (*Cholœpus didactylus*) is a native of the West Indies, where it is not uncommon, although but seldom seen. Except when in motion, the sloth is a most inconspicuous being, looking far more like an excrescence upon the bark than a living creature.

The Three-toed Sloth, or Ai (*Bradypus tridactylus*), is found in South America, where it is tolerably common. This animal may be easily distinguished from the preceding, not only by the additional toe on the foot, but also by the curious black mark upon the back, which looks exactly as if it had been caused by the application of a hot iron. The hair is curiously formed, being stout and coarse at the extremity, and tapering gradually towards the root, in somewhat the same manner as that of the duckbill.

Besides these two species, several other sloths are known to exist, but as the habits are very similar in all, it will be unnecessary to particularise them.

(*To be continued.*)

—o—

EXPLORATION OF THE MEDITERRANEAN SEA.—American enterprise has undertaken a complete survey of this interesting region. Its depth and its temperature are to be carefully examined, and the density and the chemical composition of its waters to be accurately investigated. The geological character of the bottom, the swiftness, general direction, and courses of its currents, with their action on the coasts, are to be worked out. Nor are its biological features to be overlooked, special notice being taken of the fauna and flora of the deeper portions. The United States steamer *Washington* has been selected as the vessel with which the survey shall be undertaken.

THE ELECTRIC LIGHT AT GENEVA.—The city of Geneva intends to utilise the current of the Rhone for lighting the whole of the city. A report on the question is being drawn up, which will be submitted to the Council of State.

Query Column.

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher*, *Pilgrim Street, Ludgate Hill, London, E.C.*

Algebra.

1. STUDENT.—Solve :—

$$\left.\begin{aligned} x+y&=72\\ \sqrt[3]{x}+\sqrt[3]{y}&=6\end{aligned}\right\}.$$

$$\left.\begin{aligned} (1)\quad x+y&=72\\ (2)\quad \sqrt[3]{x}+\sqrt[3]{y}&=6\end{aligned}\right\}$$

$$\left.\begin{aligned} (1)\text{ Divided by }2)\quad & x^{\frac{2}{3}}-x^{\frac{1}{3}}y^{\frac{1}{3}}+y^{\frac{2}{3}}=12\\ (2)\text{ Squared}\quad & x^{\frac{2}{3}}+2x^{\frac{1}{3}}y^{\frac{1}{3}}+y^{\frac{2}{3}}=36\end{aligned}\right\}$$

$$-3x^{\frac{1}{3}}y^{\frac{1}{3}}=-24$$

$$x^{\frac{1}{3}}y^{\frac{1}{3}}=8$$

$$\therefore\ \underline{xy=512.}$$

$$\left.\begin{aligned} (1)\text{ Squared}\quad & x^2+2xy+y^2=5184\\ & 4xy\quad\ =2048\end{aligned}\right\}$$

$$x^2-2xy+y^2=3136$$

$$x-y=\pm 56$$

$$x+y=72$$

$$2x=128,\text{ or }16$$

$$\left.\begin{aligned} \therefore\ x&=64,\text{ or }8,\\ y&=8,\text{ or }64.\end{aligned}\right\}$$

2. MANUS.—Solve :—

$$\left.\begin{aligned} \frac{x}{a}+\frac{y}{b}&=1-\frac{x}{c}\\ \frac{y}{a}+\frac{x}{b}&=1+\frac{y}{c}\end{aligned}\right\}\quad(\textit{Barnard Smith.})$$

$$\left.\begin{aligned} \frac{x}{a}+\frac{y}{b}&=1-\frac{x}{c}\\ \frac{y}{a}+\frac{x}{b}&=1+\frac{y}{c}\end{aligned}\right\}$$

$$\left.\begin{aligned} \frac{x}{a}+\frac{x}{c}+\frac{y}{b}&=1\\ \frac{x}{b}+\frac{y}{a}-\frac{y}{c}&=1\end{aligned}\right\}$$

$$\left.\begin{aligned} (bc+ab)x+acy&=abc\\ acx+(bc-ab)y&=abc\end{aligned}\right\}$$

$$\left.\begin{aligned} (bc+ab)(bc-ab)x+ac(bc-ab)y&=abc(bc-ab)\\ a^2c^2x+ac(bc-ab)y&=a^2bc^2\end{aligned}\right\}$$

$$(b^2c^2-a^2b^2-a^2c^2)x=abc(bc-ab-ac)$$

$$\therefore\ x=\frac{abc(bc-ab-ac)}{b^2c^2-a^2b^2-a^2c^2},$$

$$\text{or}\ \underline{\frac{abc(ab+ac-bc)}{a^2b^2+a^2c^2-b^2c^2}}.$$

$$\left.\begin{aligned} ac(bc+ab)x+a^2c^2y&=a^2bc^2\\ ac(bc+ab)x+(bc+ab)(bc-ab)y&=abc(bc+ab)\end{aligned}\right\}$$

$$(a^2c^2-b^2c^2+a^2b^2)y=abc(ac-bc-ab)$$

$$\therefore\ \underline{y=\frac{abc(ac-ab-bc)}{a^2b^2+a^2c^2-b^2c^2}}.$$

3. O. H. F.—Find the scale to which 24065 belongs, its equivalent in the denary scale being 6221.

Let x denote the radix,

Then, $6221=2x^4+4x^3+6x+5$

$$2x^4+4x^3+6x=6216$$

$$x^4+2x^3+3x=3108;$$

The value of x will be found *by trial* to be 7.

4. ROMAN WALL.—I have a legacy of £250. Duty paid out was £8. The remainder is invested at 4 per cent. per annum. An income of £22 per annum is to be paid out of the legacy—half-yearly. How long may the income be paid before the legacy is exhausted?

Let A denote a half-yearly payment in pounds, n the No. of payments, R the amount of one pound in $\frac{1}{2}$ year, and P the present amount.

$$\text{Then, P}=\frac{\text{A}(1-\text{R}^{-n})}{\text{R}-1};$$

$$\therefore\ 242=\frac{11\{1-(\frac{2}{2}\frac{1}{0})^{-n}\}}{\frac{2}{2}\frac{1}{0}-1}$$

$$=\frac{11\{1-(\frac{2}{2}\frac{0}{1})^{n}\}}{\frac{1}{2}\frac{1}{0}}$$

$$=550\{1-(\tfrac{2}{2}\tfrac{0}{1})^{n}\}$$

$$\tfrac{2}{2}\tfrac{1}{0}\tfrac{1}{0}=1-(\tfrac{2}{2}\tfrac{0}{1})^{n}$$

$$(\tfrac{2}{2}\tfrac{0}{1})^{n}=1-\tfrac{1}{2}\tfrac{1}{0}\tfrac{1}{0}$$

$$=\tfrac{2}{2}\tfrac{0}{1}\tfrac{1}{0}\tfrac{1}{0}$$

$$\therefore\ n=\frac{\log 154-\log 275}{\log 50-\log 51}$$

$$=\frac{\log 275-\log 154}{\log 51-\log 50}$$

$$=\frac{2\cdot4393327-2\cdot1875207}{1\cdot7075702-1\cdot69897}$$

$$=\frac{\cdot251812}{\cdot0086002}$$

$$=29\cdot28\text{ nearly};$$

$$\text{Time}=14\cdot64\text{ years (nearly).}$$

$$\therefore\ \text{The income may be paid }\underline{14\tfrac{1}{2}\text{ years.}}$$

5. A man bought a horse, and by agreement was to give a farthing for the first nail, 3 for the second, etc. Now supposing there were 8 nails in each of the four shoes, what was the price of the horse? (*Walkingame.*)

We require the sum of a geometrical series, where first term = 1, ratio = 3, and No. of terms = 32.

$$\text{S}=\frac{a(r^n-1)}{r-1};$$

$$\therefore\ \text{Amount}=\left\{\frac{1\times(3^{32}-1)}{3-1}\times\frac{1}{2}\frac{1}{0}\right\}\text{£}$$

$$=\frac{18530201888518\,41-1}{1920}\text{£}$$

$$=\underline{\text{£}965,114,681,693\ 13\text{s. }4\text{d.}}$$

6. ESOMAL.—If $(a+b)(x+y)=2(ab+xy)$, and $(c+d)(x+y)=2(cd+xy)$, prove that

$$\left(\frac{x-y}{2}\right)^2=\frac{(a-c)(a-d)(b-c)(b-d)}{(a+b-c-d)^2}.$$

(*Dublin University*, 1882.)

$$\left.\begin{aligned}(a+b)(x+y)&=2(ab+xy)\\(c+d)(x+y)&=2(cd+xy)\end{aligned}\right\}$$

$$\therefore \frac{(a+b)(x+y)}{(c+d)(x+y)}=\frac{2(ab+xy)}{2(cd+xy)}$$

$$\frac{a+b}{c+d}=\frac{ab+xy}{cd+xy}$$

$$cd(a+b)+xy(a+b)=ab(c+d)+xy(c+d)$$
$$xy(a+b)-xy(c+d)=ab(c+d)-cd(a+b)$$
$$xy(a+b-c-d)=ab(c+d)-cd(a+b)$$
$$\therefore xy=\underline{\frac{ab(c+d)-cd(a+b)}{a+b-c-d}}.$$

$$\left.\begin{aligned}(a+b)(x+y)&=2(ab+xy)\\&=2\left\{ab+\frac{ab(c+d)-cd(a+b)}{a+b-c-d}\right\}\\&=2\left\{\frac{ab(a+b)-ab(c+d)+ab(c+d)-cd(a+b)}{a+b-c-d}\right\}\\&=2\left\{\frac{ab(a+b)-cd(a+b)}{a+b-c-d}\right\}\\&=2\frac{(ab-cd)(a+b)}{a+b-c-d}\end{aligned}\right.$$

$$\therefore x+y=\frac{2(ab-cd)}{a+b-c-d};$$

$$\left.\begin{aligned}x^2+2xy+y^2&=\frac{4(ab-cd)^2}{(a+b-c-a)^2}\\4xy&=\frac{4\{ab(c+d)-cd(a+b)\}}{a+b-c-d}\end{aligned}\right\}$$

$$\frac{x^2-2xy+y^2}{4}=\frac{(ab-cd)^2-\{ab(c+d)-cd(a+b)\}(a+b-c-d)}{(a+b-c-d)^2}$$

$$\left(\frac{x-y}{2}\right)^2=\frac{\begin{aligned}&a^2b^2-2abcd+c^2d^2-(a^2bc+a^2bd-a^2cd\\&-4abcd+ab^2c+ab^2d-b^2cd-abc^2\\&+ac^2d+bc^2d-abd^2+acd^2+bcd^2)\end{aligned}}{(a+b-c-d)^2}$$

$$=\frac{\begin{aligned}&a^2b^2+c^2d^2-a^2bc-a^2bd+a^2cd+2abcd\\&-ab^2c-ab^2d+b^2cd+abc^2-ac^2d-bc^2d\\&+abd^2-acd^2-bcd^2\end{aligned}}{(a+b-c-d)^2}$$

$$=\frac{\begin{aligned}&a^2b^2-a^2bc-a^2bd+a^2cd-ab^2c+abc^2+abcd\\&-ac^2d-ab^2d+abcd+abd^2-acd^2\\&+b^2cd-bc^2d-bcd^2+c^2d^2\end{aligned}}{(a+b-c-d)^2}$$

$$=\frac{\begin{aligned}&a^2(b^2-bc-bd+cd)-ac(b^2-bc-bd+cd)\\&-ad(b^2-bc-bd+cd)+cd(b^2-bc-bd+cd)\end{aligned}}{(a+b-c-d)^2}$$

$$=\frac{(a^2-ac-ad+cd)(b^2-bc-bd+cd)}{(a+b-c-d)^2}$$

$$=\underline{\frac{(a-c)(a-d)(b-c)(b-d)}{(a+b-c-d)^2}}.$$

7 DELICIOLAE.—Solve :—

$$9\sqrt{x^2-9x+28}+9x=x^2+36. \quad (\textit{Todhunter.})$$

$$9\sqrt{x^2-9x+28}+9x=x^2+36$$
$$2\sqrt{x^2-9x+28}=x^2-9x+36$$
$$=(x^2-9x+28)+8$$
$$(x^2-9x+28)-9\sqrt{x^2-9x+28}=-8$$
$$(x^2-9x+28)-9\sqrt{x^2-9x+28}+(\tfrac{9}{2})^2=-8+\tfrac{81}{4}$$
$$=\frac{81-32}{4}$$
$$=\tfrac{49}{4}$$
$$\sqrt{x^2-9x+28}+\tfrac{9}{2}=\pm\tfrac{7}{2}$$
$$\sqrt{x^2-9x+28}=\pm\tfrac{7}{2}-\tfrac{9}{2}$$
$$=-8, \text{ or } 1$$
$$x^2-9x+28=64, \text{ or } 1$$
$$x^2-9x=36, \text{ or } -27$$
$$x^2-9x+(\tfrac{9}{2})^2=36+\tfrac{81}{4}, \text{ or } -27+\tfrac{81}{4}$$
$$=\frac{144+81}{4}, \text{ or } \frac{81-108}{4}$$
$$=\tfrac{225}{4}, \text{ or } -\tfrac{27}{4}$$

(Now $\sqrt{-\frac{27}{4}}$ is an impossible quantity.)

$$x-\tfrac{9}{2}=\pm\tfrac{15}{2}$$
$$x=\pm\tfrac{15}{2}+\tfrac{9}{2}$$
$$\therefore \underline{x=12, \text{ or } -3. \text{ Ans.}}$$

8. CYMRO.—A railway carries 1st, 2nd, and 3rd-class passengers between A and B. The fares were one year in the ratio 7 : 5 : 4 ; the total number of passengers carried was 100,000, and the receipts £49,000. The next year the third-class fare was reduced 25 per cent., and it was found that while the number of third-class passengers increased 50 per cent., the second-class diminished 10 per cent., and the first 5 per cent. ; the number of passengers increased to 121,000, and the receipts to £49,300. Find the first, second, and third-class fares, and the numbers of passengers during the first year. (*Matriculation*, June, 1883.)

Let $x=$ first-class fare in pounds,

Then, $\frac{5x}{7}=$ second " " " ,

And, $\frac{4x}{7}=$ third " " " ;

Also, let $y=$ No. of 1st-class passengers during 1st year,
And let $z=$ " " 2nd " " " " ,
Then $100{,}000-y-z=$ " " 3rd " " " " ;

$$\therefore (1)\quad xy+\frac{5xz}{7}+\frac{4x(100000-y-z)}{7}=49{,}000$$
$$(2)\quad \frac{100000-y-z}{2}-\frac{y}{20}-\frac{z}{10}=21{,}000$$
$$(3)\quad \frac{19xy}{20}+\frac{9xz}{14}+\frac{9x(100000-y-z)}{14}=49{,}300$$

$$\left.\begin{aligned}(1)\quad &3xy+xz+400{,}000x=343{,}000\\(2)\quad &1{,}000{,}000-11y-12z=420{,}000\\(3)\quad &43xy+9{,}000{,}000x=6{,}902{,}000\end{aligned}\right\}$$
$$(2)\quad 12z+11y=580{,}000$$
$$\therefore z=\underline{\frac{580000-11y}{12}}$$

$$(1)\quad 3xy+\frac{x(580000-11y)}{12}+400{,}000x$$
$$=343{,}000$$
$$\left.\begin{aligned}25xy+5{,}380{,}000x&=4{,}116{,}000\\(3)\quad 43xy+9{,}000{,}000x&=6{,}902{,}000\end{aligned}\right\}$$
$$\left.\begin{aligned}1075xy+231{,}340{,}000x&=176{,}988{,}000\\1075xy+225{,}000{,}000x&=172{,}550{,}000\end{aligned}\right\}$$
$$6{,}340{,}000x=4{,}438{,}000$$
$$\therefore x=\tfrac{7}{1000}$$
$$25xy+5{,}380{,}000x=4{,}116{,}000$$
$$(25y\times\tfrac{7}{1000})+(5{,}380{,}000\times\tfrac{7}{1000})=4{,}116{,}000$$
$$\frac{35y}{2}=4{,}116{,}000-3{,}766{,}000$$
$$=350{,}000$$
$$\therefore y=20{,}000$$
$$z=\frac{580000-11y}{12}$$
$$=\frac{580000-220000}{12}$$
$$=\underline{30{,}000}$$

$$\left.\begin{aligned}\therefore \text{ First-class fare}&=14\text{s.}\\\text{Second " "}&=10\text{s.}\\\text{Third " "}&=8\text{s.}\end{aligned}\right\}$$

$$\left.\begin{aligned}\text{No. of first-class passengers}&=20{,}000\\\text{" second " "}&=30{,}000\\\text{" third " "}&=50{,}000\end{aligned}\right\}$$

Arithmetic.

1. P. W. S.—There are 4 casks of different sizes. The 1st is filled with liquid, the rest are empty. The 2nd cask is filled from the first, and $\frac{1}{4}$ths of the original liquid in the 1st remains. The 3rd is then filled from the 2nd, and $\frac{1}{3}$th of the liquid in the 2nd remains. The liquid in the 3rd is then poured into the 4th, and fills $\frac{9}{16}$ths of it. Had the 3rd and 4th casks been filled from the contents of the 1st, 15 gallons would still have remained in the 1st. Find the size of each cask. (*Barnard Smith's* 'Shilling Arithmetic.')

$\frac{3}{4}$ of 1st cask fills 2nd cask,
$\frac{3}{4}$,, 2nd ,, ,, 3rd ,, ,
$\therefore \frac{3}{4}$ of $\frac{3}{4}$,, 1st ,, ,, ,, ,, ,
$\frac{9}{16}$,, ,, ,, ,, ,, ;
$\frac{9}{16}$,, ,, ,, ,, ,, $\frac{9}{16}$ of 4th cask,

$\therefore \frac{9}{16} \times \frac{7}{9} \times \frac{4}{7}$,, ,, ,, ,, 4th cask,

$\frac{4}{7}$,, ,, ,, ,, ,, ,, ;
$\therefore (\frac{9}{16}+\frac{7}{9})$,, ,, ,, ,, 3rd and 4th casks,
$\frac{193}{144}$,, ,, ,, ,, ,, ,, ,, ;
$\therefore \frac{9}{16}$ of 1st cask = 15 gals.,
$\therefore$ 1st cask holds 15 gals. $\times \frac{16}{9}$ = 140 gals.,
2nd ,, ,, $\frac{3}{4}$ of 140 gals. = 60 gals.,
3rd ,, ,, $\frac{3}{4}$ of 60 gals. = 45 gals.,
4th ,, ,, $\frac{4}{7}$ of 140 gals. = 80 gals.

2. PRINCE HAL.—A and B can do a piece of work alone in 12 and 16 days respectively. They work together at it for 3 days, when A leaves it, but B continues, and after 2 days is joined by C, and they finish it together in 3 days; in what time could C do it alone? (*Colenso.*)

A can do the work in 12 days,
B ,, ,, ,, 16 ,,
$\therefore$ A ,, ,, 1 day $\frac{1}{12}$ of the work,
B ,, ,, ,, ,, $\frac{1}{16}$,, ,, ;
Part done by A = $\frac{1}{12} \times 3 = \frac{1}{4}$,
,, ,, ,, B = $\frac{1}{16} \times 8 = \frac{1}{2}$,
$\therefore$,, ,, ,, C = $1 - (\frac{1}{4}+\frac{1}{2}) = \frac{1}{4}$;
C can do $\frac{1}{4}$ of the work in 3 days,
$\therefore$ C can do the work in 12 days.

3. J. EDWARDS.—A druggist takes a fluid ounce of a drug and dilutes it with 9 times its quantity of water supposed to be pure. He takes an ounce of the mixture and dilutes it again in the same proportion, and repeats the operation a third time. He afterwards finds that the water, which he had supposed pure, had been previously mixed with the same drug in the proportion of 99 : 1. What difference will this make in the strength of the mixture? (*Lower Division Examination*, May, 1881.)

Amount of drug in 9 oz. of water = $\frac{1}{10}$ oz.;
$\therefore$ Increase of strength in 1 oz. of mixture (1st time) = $\frac{9}{100}$ oz.,
,, ,, ,, ,, (2nd time) = $(\frac{9}{100} + \frac{9}{1000})$ oz.
,, ,, ,, ,, (3rd time) = $(\frac{9}{100} + \frac{9}{1000} + \frac{9}{10000})$ oz.
= $\frac{999}{10000}$ oz.

$\therefore$ Strength of mixture will be raised from $\frac{1}{100}$ to $(\frac{1}{100} + \frac{999}{10000})$ or $\frac{1999}{10000}$.

4. INDIAN BEAR'S HEART.—When wheat was at 75s. a qr. the 4-lb. loaf was sold for 7½d., but when wheat rose 5s. a qr. the price of the 6-lb. loaf was raised to 1s.; suppose the cost of converting wheat into bread be at the rate of 2s. 4d. per cwt., how much would the bakers lose or gain on every £1 of receipts by the alteration of prices?

Cost of converting 1 cwt. = 2s. 4d.
,, ,, 1 lb. = ¼d.,
,, ,, 4 lbs. = 1d.,
,, ,, 6 lbs. = 1½d.

$\therefore$ 75 s. : 80 s. :: 4 lbs. : 6 lbs. :: 6½ d. : Corresponding price for 6-lb. loaf.

$$= \frac{\cancel{4}^{1} \times \cancel{13}^{1}}{\cancel{75}^{\cancel{15}} \times \cancel{4}^{1} \times \cancel{2}^{1}} \text{d.}$$
$$= \frac{13}{2} \text{d.}$$
$$= 10\tfrac{1}{2} \text{d.}$$

$\therefore$ Gain on 1s. receipts by alteration = 10½d. − 10⅜d.
= ⅛d.,
,, £1 ,, ,, = ⅛d. × 20
= 2½d. Ans.

5. F. S.—The population of a country increases 3 per cent. annually, but is decreased annually to the extent of one-half per cent. on the whole. What will be the increase per cent. in 3 years? (*Lower Division, Civil Service*, Nov., 1880.)

Increase = 3%. =	100
	3
	103
Decrease = ½%. =	·515
	102·485
Increase = 3%. =	3·07455
	105·55955
Decrease = ½%. =	·52779775
	105·03175225
Increase = 3%. =	3·1509525675
	108·1827048175
Decrease = ½%. =	·5409135240875
	107·6417912934125

$\therefore$ Increase per cent. in 3 years = 7·6417912934125. Ans.

Mensuration.

1. YELSERP.—The sides of a triangle are 111, 175, and 176; two straight lines are drawn across parallel to the longest side, and dividing each of the other sides into 3 equal parts; find the areas of the 3 parts into which the triangle is divided. (*Todhunter.*)

(111 + 175 + 176) ÷ 2 = 231; 231 − 176 = 55; 231 − 175 = 56; 231 − 111 = 120.

Area of whole triangle = $\sqrt{231 \times 55 \times 56 \times 120}$
$= \sqrt{7 \times 3 \times 11 \times 5 \times 11 \times 7 \times 8 \times 8 \times 15}$
$= \sqrt{7^2 \times 15^2 \times 11^2 \times 8^2}$
$= 7 \times 15 \times 11 \times 8$
$= 9240.$

Similar triangles are to one another as the squares of their homologous sides.

$\therefore$ Area of 1st part = $(\frac{1}{3})^2$ of 9240
= ⅓ of 9240
= 1026⅔;
,, ,, and 2nd parts = $(\frac{2}{3})^2$ of 9240
= ⅔ of 9240;
$\therefore$,, 2nd part = ⅔ or ½ of 9240
= 3080;
$\therefore$,, 3rd ,, = (1 − ⅓) of 9240;
= ⅔ of 9240
= 5133⅓.

Note.—(1) Writing *good*, but rather small. (2) No.

General.

1. PRACTICAL will, as a candidate for admission to a Training College, obtain extra marks for only *one* language and *one* science subject besides those awarded for drawing; and

2. RALPH will find in the Fifth Schedule that Botany is one of the twelve science subjects specified.

3. INQUIRER will find the Science Questions of last May in *The Schoolmaster* of July 14th. We know of no collection of the entire series. The Honours Certificate can be obtained in Mathematics only by studying the best works on the subject. You should consult the Directory for details.

4. WORAJ.—The 'Lessons on Latin' given in THE PRACTICAL TEACHER will be sufficient for any examination. We cannot, however, say when they will be finished.

5. AVDIA.—We are willing at any time to help you with any query, but we cannot answer those that occupy a page or more.

6. TEACHER.—Your solution is correct, the number of turtles being 19.

7. WAKE.—The solution of your equation appeared in our issue for July, 1882.

8. ROMEO II.—Your query is solved in our issue for March, 1883.

9. X. Y. Z.—Give an analysis of these lines, and parse the words *underlined*.

"The primal duties shine aloft—like *stars*;
The charities that soothe, and heal, and bless,
Are scattered at the feet of man—*like* flowers—
The generous *inclination*, the just rule,
Kind wishes, and good *actions* and pure *thoughts*—
No mystery is here; no special boon
For *high* and not for low, for proudly *graced*
And not for meek *of* heart. The smoke ascends
To heaven as lightly from the cottage hearth
As from the haughty palace."

Excursion Book IX. 236-245.

SENTENCE.	KIND OF SENTENCE.	CONNECTIVE.	SUBJECT.	PREDICATE.	OBJ.	EXTENSION OF PREDICATE.
(*a*) The primal duties shine aloft like stars.	Princ. sent.		The primal duties	shine	...	aloft (place) like stars (manner)
(*b*) The charities, the generous inclination, the just rule, kind wishes and good actions, and pure thoughts, are scattered at the feet of man like flowers.	Princ. sent.		The charities, the generous inclination, the just rule, kind wishes and good actions, and pure thoughts,	are scattered	...	at the feet of man (place) like flowers (manner)
(*c*) that soothe,	Adj. sentence to 'charities' in *a*.	contained in *rel. pro.*	that	soothe		
(*d*) and heal,	*do.* co-ord. with *c*.	and	[that]	heal		
(*e*) and bless.	*do.* co-ord. with *c.* and *d*.	and	[that]	bless		
(*f*) No mystery is here,	Princ. sent.		no mystery	is here		
(*g*) No special boon for high,	Princ. sent.		no special boon for high	[is here]		
(*h*) and not for low,	Princ. sent. co-ord. with *g*.	and	[no special boon] not for low	[is here]		
(*i*) for proudly graced,	Princ. sent.		[no special boon] for proudly graced	[is here]		
(*j*) and not for meek of heart.	Princ. sent. co-ord. with *i*.	and	[no special boon] not for meek of heart	[is here]		
(*k*) The smoke ascends to heaven as lightly from the cottage hearth	Princ. sent.		The smoke	ascends	...	to heaven from cottage hearth (place) as lightly (manner)
(*l*) as from the haughty palace.	Adv. sentence (manner) to *k*.	as	[it]	[ascends]	...	from the haughty palace (place)

PARSING.

Stars—Com. noun, plu. no., neut. gen., 3rd pers., obj. case gov. by 'to,' understood.

The case of stars depends upon the use of '*like*.' See next word, where 'like' is parsed as before 'stars' or 'flowers.'

like—adj. qual. 'manner,' understood,
or, adj. gov. 'stars' (Dr. Latham);
or, cop. conj. joining 'duties shine,' and 'stars shine,' =as.

inclination—abs. noun, neut., sing., 3rd pers., nom. in apposition with 'charities.'

actions—abs. noun, neut., plur., 3rd pers., nom. in appn. with 'charities.'

thoughts—abs. noun, neut., plu., 3rd pers., nom. in appn. with 'charities.'

no—num. adj.' qual. 'mystery.'

mystery—abs. noun, neut., sing., 3rd pers., nom. to 'is.'

is—irr. int. verb, act., ind., pres., 3rd pers., sing., agreeing with 'mystery.'

here—adv. of place. qual. 'is.'

high—adj. used as a noun, neut., sing., 3rd pers., obj. gov. by 'for.'
or, adj. qual. 'people,' und.

graced—as 'high.'

of—prep., showing the relation between 'meek' and 'heart.'

as—cop. conj., joining 'smoke ascends,' etc., and 'it ascends,' understood.

10. STUART cannot obtain his 'D' at Christmas. He must sit either at the drawing examination of his school, or at the general examinations in May next. Consult any head-teacher.

11. UNICORN is a fabulous animal. There are animals with but one 'horn,' but not of the character described. We suspect that it belongs a cetacean.

12. SYRIAC may sit for as many subjects as he pleases. *Professor Tanner's* 'Agriculture,' 9d. and 3s. 6d.; or *Wrightson's* 2s. *Huxley's* 'Physiography,' 7s. 6d.; or *Collins'*, 1s. 6d.; or *Chambers'*, 1s. 6d. *Roscoe's* 'Chemistry,' 4s. 6d. Besides *Currie's* 'School Management,' there are *Gill's* and the 'Complete Manual of Teaching' (National Society).

13. WILD HEN.—We do not know the 'International Microscope' specially, but we should think it would quite suffice. All the practical work required for animal physiology can be done with a microscope having a $\frac{1}{4}$ and a 1" object-glass. A microscope possessing these can be obtained for from five to six guineas. We specially recommend Crouch's, 66, Barbican, E.C.

14. P. M.—You will find the solution of your query in our issue for April, 1883.

15. J. C. W.—The smaller of two non-concurrent parallel forces is 15, the resultant is 45, acting at a distance of 56 from the smaller component; what is the distance between the components? (*Newth.*)

Let x = distance between the components;
Greater force = 45 + 15
= 60;
$\therefore 60x = 45 \times 56$
$= 2520$
$\therefore x = 42$. Ans.

Note.—The resultant of two non-concurrent parallel forces does not pass between them.

16. HOPEFUL.—We cannot reply to anonymous queries.

17. OLD SUBSCRIBER will probably find *Canon Daniel's* 'History, Language, and Contents of the Prayer-Book' sufficiently comprehensive (6s.). The *National Society* publishe

'Questions on the Collects' (1s. 8d.). *Gedge's* 'Companion to the Prayer-Book (Part III.) on the Communion' (6d.) is published by *Rivington's*.

18. DEVONIAN.—Is it a general or special encyclopædia? Give limit of price. We know of no large wall-map of Devonshire prepared for schools; inquire of local bookseller. 'Copy-books to be shown,' see Code, Schedule I., Standard I. No wise teacher will long remain without a copy of the Code for constant reference. *Heller's* edition is well annotated and indexed, price 1s.

—o—

Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

STANDARD I.

Arithmetic.

(*Infants' Departmen'.*)

356	714	545
19	3	208
402	30	
87	258	337
591	97	Write out 6 times or 4 times.
1455	1102	

(*Words Dictated.*)

A big dog. Large house. New book. Black horse. Three little boys. The green grass. My good mother.

(*Boys' Department.*)

A.	B.
6304	2059
87	618
417	24
1883	4307
296	195
8987	7203
9106	8021
6328	5475
2778	2546
6 times.	4 times.

(*Words.*)

House. Garden. School. Teacher. Copy. late. Pencil. Morning. Evening. Night.

STANDARD II.

Arithmetic.

A	B
83,761 ÷ 9 = 9306 − 7	95,364 ÷ 8 = 11,920 − 4
64,389 × 476 = 30,649,164	56,482 × 379 = 21,406,678
81,205 − 46,738 = 34,467	93,014 − 66,247 = 26,767

Dictation.

In stormy weather no ship dares go among the floating icebergs. As they roll about in the waves, they would crush to pieces the strongest ship ever built. There is often great danger in going near an iceberg, even when the sea is calm,

Grammar.

After reading lesson, boys pointed out nouns and verbs orally.

Geography.

What is an island? A strait? How is the earth's surface divided? What is the largest division of water? Name them. Which do we live near? How should we get to it from here? What is a river? Its beginning? End? What continent are we in? Country? What is it a part of? Is it an island? If not, what is it? What is a map? What is the line drawn across the map of the world? What kind of countries are they there? What are those parts of land called in which scarcely anything grows? What animal is used in the desert? Why better than a horse?

STANDARD III.

Arithmetic.

(*On Cards—chiefly in Words.*)

A. (1) £3096 19s. 3½d. + £47 0s. 7d. + £78 5s. 9½d. + £422 16s. 3¾d. + £1801 8s. 11½d. + £54,490 11s. 10½d. Ans. £59,937 2s. 9½d.
(2) £3146 − £427 19s. 9½d. Ans. £2718 0s. 2½d.
(3) 13,960 ÷ 13. Ans. 1073 − 11.
(4) In one house there were 350 bricks, and in another 12 times as many. How many altogether, with 160 more? Ans. 4710.

B. (1) £8902 19s. 10d. + £99 17s. 6½d. + £17,009,029 6s. 0¾d. + £1,099,060 10s. 2d. Ans. £18,117,092 13s. 7¼d.
(2) 497,500 ÷ 836. Ans. 595 − 80.
(3) £93,014 7s. 6d. − £20,009 19s. 10d. Ans. £73,004 7s. 8d.
(4) A lent B £400. B returned £26 10s. 8d. + £60 19s. 11⅜d. How much did he still owe? Ans. £312 9s. 4¼d.

Dictation.

The sweetest song-bird to be found in the British Islands is the nightingale. It is seldom seen in the northern parts of the country, but in summer it is common in some of the southern counties of England. It is a plain brown bird, with nothing to attract us in its appearance.

Grammar.

Point out the nouns, adjectives, adverbs, verbs, and pronouns in the above.

Geography.

Name the chief English rivers on the E. coast in order from north to south. Give the boundaries of England. Name the smaller islands. Name towns on Tyne, Wear, and Trent. What parts of England are manufacturing? Name chief manufactures. Where is the cotton manufacture carried on? Name chief towns engaged in it. Do. woollen manufacture? What part of England has the highest mountains? Name them. What ranges are in the S.W. and S.? Name any other hills in England. What part of England is *rather* flat? What part especially so? What

great town is there in Warwickshire, and what does it manufacture? Name any towns on south coast. Seaport in Hampshire. In Yorkshire. Where is copper smelting carried on? In what counties is the Lake District? In what direction do most English rivers flow? Why is South Staffordshire called Black Country? Name the principal coalfields, with their manufactures.

STANDARD IV.

Arithmetic.

(1) From £900 12s. $0\frac{1}{2}$d. take £7 16s. $0\frac{3}{4}$d., and multiply the remainder by 79.
Ans. £70,531 2s. $4\frac{1}{4}$d.

(2) Divide £598,790 19s. 9d. equally among 12 men?
Ans. £49,899 4s. $11\frac{1}{4}$d.

(3) Turn 3168 pecks of corn into quarters, and 3168 pecks into pints. Ans. 99 qrs.; 50,688 pints.

(4) A man owed £10,000; he paid £500 0s. 6d., and then £4007; how much has he still?
Ans. £5492 19s. 6d.

STANDARD V.

(1) Make out a bill for the following:—

		s.	d.	
$45\frac{1}{2}$ lbs.	of cheese at	3	$6\frac{1}{2}$	per lb.
300 lbs.	„ salt	„ 0	$0\frac{3}{4}$	„
$4\frac{1}{2}$ lbs.	„ tea	„ 2	6	„
$29\frac{1}{2}$ yds.	„ velvet	„ 4	10	per yd.
$15\frac{1}{2}$ yds.	„ silk	„ 5	$9\frac{1}{2}$	„
54	stair rods	„ 2	6	per doz.

Ans. £21 14s. 9d.

(2) If 18 yds. of silk cost £5 17s., what will 6 pieces, each having 27 yds., cost at the same price?
Ans. £52 13s.

(3) Find, by Practice, the cost of 9007 suits of clothes at £1 13s. $5\frac{1}{4}$d. each.
Ans. £15,058 11s. $6\frac{3}{4}$d.

(4) 55 miles 7 fur. 38 poles at £4 13s. 4d. a mile.
Ans. £261 6s. 1d.

STANDARDS VI. AND VII.

(1) From 1000 take the sum of $80{\cdot}05 + 706{\cdot}037 + {\cdot}0053 + 8{\cdot}5$, and divide the remainder by ·03.
Ans. $6846{\cdot}92\dot{3}$.

(2) A man received $\frac{3}{8}$ of $\frac{5}{7}$ of 2 guineas + $\frac{3}{5}$ of $\frac{9}{10}$ of 5 shillings, and paid away $\frac{2}{3}$ of a crown + $\frac{1}{16}$ of 8s. 1d.; how much has he now?
Ans. 11s. $0\frac{1}{4}\frac{3}{4}$d.

(3) If £640 gain £55 10s. in 3 years, how many pounds ought £1000 to gain in $2\frac{1}{2}$ years?
Ans. £72 5s. $3\frac{3}{4}$d.

(4) At what rate per cent. will £880 amount to £1320 in $7\frac{1}{2}$ years?
Ans. $6\frac{2}{3}$.

Science Notes.

THE ISLAND OF ISCHIA AND ITS EARTHQUAKES.—The late serious disaster which has overwhelmed Casamicciola, and greatly damaged other places near, has drawn attention to the remarkable frequency with which similar occurrences have taken place. Of the shocks which have been most deplorable in their effects, those of 1827, of 1881, and of the present year are the most noteworthy. The first of these destroyed the greater part of Casamicciola, the scene of the present calamity. Besides this town, other places near suffered severely. In the earthquake of 1881 many houses were levelled with the ground, and much damage was done. The lamentable results of that of the present year are fresh in all our minds. In each case a special area has been affected. As in the case of the shock of 1881, a most striking feature of the late earthquake is its extremely local character. There was no simultaneous perceptible tremor at Naples, and no sympathetic movement was registered on Mount Vesuvius. It can hence be inferred with confidence that the source of the shock was comparatively near the surface of the ground. Ischia lies in a volcanic district, and is itself of volcanic origin, but its earthquakes do not seem to be part of the active volcanic phenomena of the district. As regards the recent catastrophe, there appear to have been no volcanic manifestations accompanying the earthquake, though there were many vents where such manifestations might have been expected to show themselves. The only facts which point to a connection between the earthquake and volcanic agencies are the reported outflow of lava from Vesuvius on the 31st July, and the alleged increase in the volume and temperature of the Ischian hot springs. These, however, are by no means conclusive evidence. It seems most likely that the earthquake was caused by the sudden collapse of some subterranean cavern situated not far below the earth's surface, in the Casamicciola district.

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DESTRUCTION OF UNIVERSITY BUILDINGS IN THE UNITED STATES.—A great loss has befallen the University of Indiana, at Bloomington, in that State. During a severe thunderstorm on the night of July 12th last the buildings were struck by lightning and set on fire, the electric fluid travelling along a telephone-wire which served the institution. The fury of the flames was fatal to the laboratories, the museum, and the library, all of which were totally destroyed. The fate of the museum was the more sad as it contained a collection of fishes made by Dr. Jordan, which was considered to be the largest and most valuable in the United States. The library contained the so-called 'Owen' collection of books, all of which were lost in the flames. Besides this, some 15,000 other volumes perished. The whole loss is said to be irreparable. The damage done amounts to something like forty thousand pounds, of which but little was covered by insurance.

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APPLICATION OF PETROLEUM AS A FUEL.—On the Russian railways, where both coal and wood are very dear, the burning of petroleum waste as fuel has taken a practical form. The successful application of it is due to Mr. T. Urquhart, who is running now several locomotives regularly which are only supplied with petroleum refuse. The economy over coal and wood is most marked. To test the point, Mr. Urquhart prepared three engines of exactly the same type, and started them on different days, under exactly similar conditions of weather, train, and section of railroad. The trips were made both ways, and on comparing the results he found that if the cost of burning

'Questions on the Collects' (1s. 8d.). *Gedge's* 'Companion to the Prayer-Book (Part III.) on the Communion' (6d.) is published by *Rivington's*.

18. DEVONIAN.—Is it a general or special encyclopædia? Give limit of price. We know of no large wall-map of Devonshire prepared for schools; inquire of local bookseller. 'Copy-books to be shown,' see Code, Schedule I., Standard I. No wise teacher will long remain without a copy of the Code for constant reference. *Heller's* edition is well annotated and indexed, price 1s.

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

STANDARD I.

Arithmetic.

(*Infants' Departmen'.*)

356	714	545
19	3	208
402	30	
87	258	337
591	97	Write out 6 times or 4 times.
1455	1102	

(*Words Dictated.*)

A big dog. Large house. New book. Black horse. Three little boys. The green grass. My good mother.

(*Boys' Department.*)

A.	B.
6304	2059
87	618
417	24
1883	4307
296	195
8987	7203
9106	8021
6328	5475
2778	2546
6 times.	4 times.

(*Words.*)

House. Garden. School. Teacher. Copy. late. Pencil. Morning. Evening. Night.

STANDARD II.

Arithmetic.

A	B
$83,761 \div 9 = 9306 - 7$	$95,364 \div 8 = 11,920 - 4$
$64,389 \times 476 = 30,649,164$	$56,482 \times 379 = 21,406,678$
$81,205 - 46,738 = 34,467$	$93,014 - 66,247 = 26,767$

Dictation.

In stormy weather no ship dares go among the floating icebergs. As they roll about in the waves, they would crush to pieces the strongest ship ever built. There is often great danger in going near an iceberg, even when the sea is calm,

Grammar.

After reading lesson, boys pointed out nouns and verbs orally.

Geography.

What is an island? A strait? How is the earth's surface divided? What is the largest division of water? Name them. Which do we live near? How should we get to it from here? What is a river? Its beginning? End? What continent are we in? Country? What is it a part of? Is it an island? If not, what is it? What is a map? What is the line drawn across the map of the world? What kind of countries are they there? What are those parts of land called in which scarcely anything grows? What animal is used in the desert? Why better than a horse?

STANDARD III.

Arithmetic.

(*On Cards—chiefly in Words.*)

A. (1) £3096 19s. 3½d. + £47 0s. 7d. + £78 5s. 9½d. + £422 16s. 3¾d. + £1801 8s. 11½d. + £54,490 11s. 10½d. Ans. £59,937 2s. 9½d.

(2) £3146 − £427 19s. 9½d. Ans. £2718 0s. 2½d.

(3) 13,960 ÷ 13. Ans. 1073 − 11.

(4) In one house there were 350 bricks, and in another 12 times as many. How many altogether, with 160 more? Ans. 4710.

B. (1) £8902 19s. 10d. + £99 17s. 6½d. + £17,009,029 6s. 0¾d. + £1,099,060 10s. 2d. Ans. £18,117,092 13s. 7¼d.

(2) 497,500 ÷ 836. Ans. 595 − 80.

(3) £93,014 7s. 6d. − £20,009 19s. 10d. Ans. £73,004 7s. 8d.

(4) A lent B £400. B returned £26 10s. 8d. + £60 19s. 11¾d. How much did he still owe? Ans. £312 9s. 4¼d.

Dictation.

The sweetest song-bird to be found in the British Islands is the nightingale. It is seldom seen in the northern parts of the country, but in summer it is common in some of the southern counties of England.

It is a plain brown bird, with nothing to attract us in its appearance.

Grammar.

Point out the nouns, adjectives, adverbs, verbs, and pronouns in the above.

Geography.

Name the chief English rivers on the E. coast in order from north to south. Give the boundaries of England. Name the smaller islands. Name towns on Tyne, Wear, and Trent. What parts of England are manufacturing? Name chief manufactures. Where is the cotton manufacture carried on? Name chief towns engaged in it. Do. woollen manufacture? What part of England has the highest mountains? Name them. What ranges are in the S.W. and S.? Name any other hills in England. What part of England is *rather* flat? What part especially so? What

great town is there in Warwickshire, and what does it manufacture? Name any towns on south coast. Seaport in Hampshire. In Yorkshire. Where is copper smelting carried on? In what counties is the Lake District? In what direction do most English rivers flow? Why is South Staffordshire called Black Country? Name the principal coalfields, with their manufactures.

STANDARD IV.

Arithmetic.

(1) From £900 12s. 0½d. take £7 16s. 0¾d., and multiply the remainder by 79.
Ans. £70,531 2s. 4¼d.

(2) Divide £598,790 19s. 9d. equally among 12 men? Ans. £49,899 4s. 11¼d.

(3) Turn 3168 pecks of corn into quarters, and 3168 pecks into pints. Ans. 99 qrs.; 50,688 pints.

(4) A man owed £10,000; he paid £500 os. 6d., and then £4007; how much has he still?
Ans. £5492 19s. 6d.

STANDARD V.

(1) Make out a bill for the following:—

		s.	d.	
45½ lbs.	of cheese at	3	6½	per lb.
300 lbs.	„ salt	„ 0	0¾	„
4½ lbs.	„ tea	„ 2	6	„
29½ yds.	„ velvet	„ 4	10	per yd.
15½ yds.	„ silk	„ 5	9½	„
54	stair rods	„ 2	6	per doz.

Ans. £21 14s. 9d.

(2) If 18 yds. of silk cost £5 17s., what will 6 pieces, each having 27 yds., cost at the same price?
Ans. £52 13s.

(3) Find, by Practice, the cost of 9007 suits of clothes at £1 13s. 5¼d. each.
Ans. £15,058 11s. 6¾d.

(4) 55 miles 7 fur. 38 poles at £4 13s. 4d. a mile.
Ans. £261 6s. 1d.

STANDARDS VI. AND VII.

(1) From 1000 take the sum of 80·05 + 706·037 + ·0053 + 8·5, and divide the remainder by ·03.
Ans. 6846·923.

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anthracite coal were represented by twenty-six, that of wood would be twenty-three, while that of petroleum refuse was only eleven. The saving was then, even in the case of the petroleum *v.* the wood, at least fifty per cent.

* * * * *

REMARKABLE SAGACITY OF A HORSE.—*Apropos* of the discussion going on in several of our contemporaries respecting the existence of the reasoning faculties in the lower animals, it is interesting to note the following well-authenticated anecdote about an animal which is not usually held up to admiration as possessing marked sagacity. A blind horse, the property of a small farmer near Reading, was turned out to graze on the common near its owner's house. One of its shoes was causing it pain from pressing into the frog, as afterwards transpired. The animal wound its way through lanes to the blacksmith's shop at which it was customarily shod. The entrance to the forge is difficult of access, on account of ditches which occur on either side; but somehow it surmounted these obstacles safely, and took up its stand by the side of the forge. The blacksmith was at the time at work in his garden, and was surprised to hear the sound of a horse's neigh. He looked round for the animal, but could not at first find out where it was. The neighing was repeated several times before he discovered that it came from his shop. There he found the animal standing very quietly by the forge, as if waiting to be shod. The blacksmith imagined some one had brought it there to be attended to, and consequently he examined its feet, discovering the injury to the frog caused by the displaced shoe. He then put on another shoe, and sent the horse back to its owner.

* * * * *

REGISTRATION OF EARTH CURRENTS.—A new piece of apparatus for registering earth currents has lately been invented by Herr Wanschaff, of Berlin. It consists of a very delicate galvanometer, enclosed in a case, and having a clockwork arrangement for moving a photographic plate steadily downwards. A fine ray of light is reflected into the mirror of the galvanometer by a total reflection prism, and is then focussed on the photographic plate. The speed of the movement of the plate is eighty milimétres per hour, thus allowing variations from minute to minute to be observed.

* * * * *

A NEW GALVANIC BATTERY.—A new battery, for which is claimed that when it is exhausted it can be restored by driving through it a current from an accumulator, is the invention of Messrs. Lelande and Chaperon. Besides this advantage, the battery gives a steady current for several hours before exhaustion, though even a low resistance be employed. It is a single liquid cell, which makes the steadiness of its current remarkable. The depolarising electrode is made of oxide of copper, the liquid used is a solution of caustic potash, and the other pole is a rod or plate of zinc. The battery is made in various forms, and is said to have an electro-motive force of nearly one volt.

* * * * *

THE SUPPOSED INTRA-MERCURIAL PLANET.—The existence of this hitherto hypothetical planet, 'Vulcan,' has been reported to be established by observations made during the late eclipse of the sun by M. Trouville, the French observer of the eclipse. Report says that M. Trouville has consulted with Professor Swift, of the Warner Observatory, regarding the identity of a certain red star which he and his assistant saw at a distance of three minutes from the sun, to the north-west of his disc. The result is to establish with approximate certainty the existence of the intra-mercurial planet.

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Publications Received.

Chambers (W. and R.)—
The Graduated Readers. Book IV.
Domestic Economy. Parts I., II., and III.
Geographical Readers. Standards II. and V.

Griffith and Farran—
Our Little Ones. August. Vol. III., No. 10.

Heywood (John)—
Queen Vashti; or, the Story of a Sister's Love. By Ella Cross.
How to Teach the Method of Unity. By Alfonzo Gardiner.
Paragon Readers. Book I.

Jarrold and Sons—
The Empire Home Lesson Books, for Standards I., II., III., IV., V., VI., and VII., and Book of Answers.

Johnston—
A Map of 'The Exodus,' or Journeyings of the Israelites from Egypt to Canaan. With Handbook.

Ledsham (J. B.)—
Ledsham's Repetition Book. Part III. With Notes, etc.

Letts, Son and Co.—
The Illustrated Household Magazine. Part VI.

Longmans and Co.—
Longman's Magazine. No. 10.

Marcus Ward and Co.—
A Short History of England. 'History Reader.' No 5.

Moffatt and Paige—
Silver Bugles. Part I.
The Song School. Parts I. and II.
May Blossoms. Parts I. and II.
The Sight Singer. Parts I. to IV.
Silver Bells. Parts I. to VI.
Silver Cymbals. Parts I. to X.

National Society's Depository—
Historical Poetry. By C. M. Yonge. Part III.
Shakspere's Plays for Schools. First Part of 'Henry IV.' By C. M. Yonge.

Nelson and Sons (T.)—
Notes of Lessons on Moral Subjects. By F. W. Hackwood.

Relfe Bros.—
Exercises for Translation in French. By Max Liebich.

Smith, Elder and Co.—
The Cornhill Magazine. No. 2. New Series.

Ward, Lock and Co.—
Standard School Board Dictionary.
The 'Good Hand' Copy Books.
The Universal Instructor. Part XXXIV.

Williams and Norgate—
Handbook of German-English Conversation. By Gustav Hein.

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The Belgian teachers will hold their Congress on September 9th and three following days, at Hasselt, Limburg. The questions of special interest proposed for discussion are: (1) Is the analytic or the synthetic method of teaching reading to be preferred? and (2) How may the knowledge, love, and practice of the moral virtues be best promoted? The Flemish and French sections meet separately; but on the 11th a vote on each question will be taken in a general meeting, which will afterwards consider the teaching of needlework in girls' schools, and the limits and best methods of instruction in history. Some members of the N.U.E.T. are invited to 'assist' at this Congress.

ANSWERS TO ARITHMETICAL QUESTIONS IN THE 'LITTLE LEARNER' FOR SEPTEMBER, 1883.

STANDARD I.

A. (1) 245
(2) 155
(3) 204

B. (1) 701
(2) 2,274
(3) 1,226

C. (1) 1,479
(2) 771
(3) 3,121

D. (1) 321
(2) 333
(3) 555

E. (1) 104
(2) 164
(3) 379

F. (1) 375
(2) 43
(3) 269

G. (1) 27,309
(2) 9,997
(3) 5,688

H. (1) 787
(2) 588
(3) 8,811

I. (1) 24,123,628
(2) 254 nuts; 305 nuts
(3) 273 oranges

J. (1) 3,012,425,448
(2) 1,788
(3) 248 boys

STANDARD II.

A. (1) 338,281
(2) 102,078
(3) 167,674

B. (1) 4,689
(2) 56,424
(3) 6,629

C. (1) 834,705
(2) 3,276,630
(3) 87,823,200

D. (1) 1,726,272
(2) 4,436,705
(3) 32,981,910

E. (1) 151,886,286
(2) 7,877,432,130
(3) 3,315,603,000

F. (1) 23,605
(2) 9,874+2
(3) 3,844

G. (1) 7,087+4
(2) 7,713
(3) 6,914+1

H. (1) 22,941+13
(2) 434+401
(3) 998+28

I. (1) 107 pence; 12s. 8d.
(2) 10,203 guineas
(3) 86,400 times

J. (1) 298 apples
(2) 33,768 nuts
(3) 1,325 men

STANDARD III.

A. (1) 2,354
(2) 678+7
(3) 1,708

B. (1) 9,470+30
(2) 10,593+65
(3) 9,007

C. (1) 5,603+112
(2) 10,806
(3) 10,887+506

D. (1) 7,400
(2) 16,751+1,292
(3) 9,897

E. (1) £38 12s. 5d.
(2) £132 6s. 8½d.
(3) £1,595 1s. 3¼d.

F. (1) £14,654 19s. 4½d.
(2) £19,348 1s. 10½d.
(3) £38,105 17s. 6d.

G. (1) £135 3s. 10d.
(2) £57 19s. 2½d.
(3) £327 15s. 7½d.

H. (1) £8,433 11s. 6½d.
(2) £33 15s. 11½d.
(3) £17,189 19s. 9½d

I. (1) 840 oranges
(2) £4 4s. 9½d.
(3) £12 13s. 4d.

J. (1) £2 1s. 11d.
(2) 13 pears
(3) £165 13s. 4½d.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR SEPTEMBER, 1883.

EXERCISE XXV.

(1) $\frac{2abx^2}{y}$; $\frac{3x}{2}$; $\frac{3a^2cx}{b}$

(2) $\frac{2a^3}{b}$

(3) $\frac{3bxy}{a}$; $\frac{10ab}{3x}$

(4) $\frac{8ac^4}{3}$

(5) $\frac{a}{c}$; $\frac{a^2}{x^2}$; 1

(6) $8ax$; $\frac{2a^3}{x}$

(7) $\frac{1}{a+b}$; $a+b$

(8) $\frac{1}{a^2-b^2}$; $\frac{a-b}{a+b}$

(9) $3c(x-y)$; $2ab(x+y)$

(10) $\frac{x^2}{4y}$; $\frac{ay^3}{8}$

(11) $\frac{xy}{x+y}$; $2ab(a-b)$

(12) $\frac{x+1}{x-3}$

(13) $\frac{(x-3)(x+5)}{x(x+4)}$

(14) $\frac{a}{a^2-b^2}$

(15) $\frac{x(a+b)}{ab}$

(16) $bc+ac+ab$

(17) $\frac{x^2-1}{x^2}$

(18) $\frac{ac+b^2}{ac-b^2}$

(19) $\frac{b^2-a^2}{a^2b^2}$

(20) $\frac{3b}{ac(a-2)}$

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR' FOR SEPTEMBER, 1883.

STANDARD IV.

A. 1. 2 d. 13 hr. 18 min.
2. £57,437 19s. 0¾d.
3. 171 times.

B. 1. 29,462,400 sec.
2. 16s. 6¾d.,—159.
3. £105 7s. 9¾d.

C. 1. 2236, and 5 lb. left.
2. 8,314,880 drams.
3. 12,006 b. 1 pk. 1 g. 7pt.

D. 1. 13 c. yd. 6 c. ft. 923 c. in.
2. £39 7s. 2¾d.
3. 6183 min.

E. 1. £402 2s. 10½d.
2. 132,858 sq. ft.
3. £1,318 16s.

F. 1. 55 yards.
2. 10,115 loaves.
3. £40 16s. 8d.

Advanced Examination.

1. 4 miles 907 yd. 2 ft. 9 in.
2. £45 11s. 9d.
3. 6 c. yd. 22 ft. 634 in.,—722.

STANDARD V.

A. 1. £253 14s. 5¼d.
2. £720 11s. 3¾d.
3. £896 17s. 6d.

B. 1. $3\frac{7}{11}$.
2. £231.
3. £8 14s. $7\frac{3}{16}$d.

C. 1. $2\frac{9}{11}$.
2. £35 3s. 9½d.
3. £3 17s. 6¾d.

D. 1. 30 score.
2. £24 8s. 7½d.
3. £35 17s. 3½d.

E. 1. $1\frac{1}{16}$.
2. £2,155 6s. 3d.
3. £46 10s. 6¾d.

F. 1. 8 to 7 (man to boy).
2. £4 1s. $2\frac{8}{11}$d.
3. £425 5s. 2½d.

Advanced Examination.

1. £1,283 15s. 9¾d.
2. $1\frac{5}{16}$.
3. £25 11s. 10½d.

STANDARD VI.

A. 1. $\frac{999}{1000}$.
2. ·055130208$\frac{1}{3}$.
3. £1 12s. 9½d.

B. 1. £21 10s. 3¾d.
2. 2,400 lb.
3. 537,188.

C. 1. $\frac{1000}{1331}$.
2. £2 7s. 2·6304d.
3. $4\frac{1}{16}$.

D. 1. $\frac{155}{1728}$.
2. £372 13s. $6\frac{13}{121}$d.
3. £10 19s. $8\frac{5}{16}$d.

E. 1. $12\frac{8}{17}$ days.
2. £635.
3. £62 2s. 6d.

F. 1. $\frac{12}{13}$.
2. $\frac{1331}{1728}$.
3. 38·7164+.

Advanced Examination.

1. $9\frac{8}{14}$ days.
2. $2\frac{1}{4}$ years.
3. ·474609+

STANDARD VII.

A. 1. 4s. $3\frac{11}{13}$d.
2. $7\frac{1}{2}$ per cent.
3. $31\frac{1}{2}$ p. ct. gain.

B. 1. £2 14s. 8d. each.
2. £78 8s. $7\frac{9}{17}$d.
3. £2400.

C. 1. $18\frac{1}{2}$ per cent.
2. $10\frac{1}{2}$ per cent. loss.
3. 6s. 6d. in the £.

D. 1. 88 lb.
2. £84 1s. 6·1125d.
3. $3\frac{1}{2}$ per cent.

E. 1. 1600 to 1617 (wheat to bread).
2. £5003 15s.
3. 8s. $4\frac{8}{21}$d.

F. 1. 8, 16, and 24 years respectively.
2. 17s.—$1\frac{13}{16}\frac{13}{16}$d.
3 $\frac{8}{171}$ or ·046875 p. ct.

Advanced Examination.

1. $27\frac{1}{2}$ per cent. gain.
2. 7 months.
3. £750.

SOLUTIONS OF THE ADVANCED EXAMINATION QUESTIONS IN 'THE SCHOLAR' FOR SEPTEMBER, 1883.

STANDARD IV.

1. 2 hr. 16 min. 15 sec. = $136\frac{1}{4}$ min. Then $25 \times 84 \times 136\frac{1}{4}$ = 286,125 inches = 4 mi. 907 yd. 2 ft. 9 in. Ans.

2. $3\frac{1}{4}$ g. = £3 8s. 3d., × 17 = £58 0s. 3d. price of 17 sheep; which + £5 10s. 6d. = £63 10s. 9d. *into* his pocket.

$14\frac{1}{2}$ g. = £15 4s. 6d. cow, + $\frac{1}{5}$ of £15 4s. 6d. = £2 10s. 9d. calf, + 3s. 9d. expenses = total £17 19s. *out of* his pocket. And £63 10s. 9d. − £17 19s. = £45 11s. 9d. Ans.

3. 6179 c. yd. 19 ft. 796 in. ÷ 905 = 6 c. yd. 22 ft. 634 in. Ans.

(Being simply a test for sustained accuracy in mechanical work, we need not go through the process.)

STANDARD V.

1. The four items are:—£323 + £51 6s. + £1023 15s. + £182 = £1580 1s., on which 3s. 9d. in the £, or $\frac{3}{20}$ = £296 5s. 2½d., which, deducted from £1580 1s. = £1283 15s. 9½d. Ans.

2. $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}=\frac{57}{60}$, and $\frac{1}{7}+\frac{3}{10}=\frac{31}{70}$; then $\frac{57}{60}+\frac{31}{70}+\frac{1}{7}+\frac{1}{8}$ $=\frac{399}{420}+\frac{186}{420}+\frac{60}{420}+\frac{52\frac{1}{2}}{420}=1\frac{697\frac{1}{2}}{840}$. Ans.

3. £2 17s. 9½d. ÷ 92½ (18½ lb. × 5) = 7½d. a lb. Again, 7½d. × 22½ × 36 = 6142½d. = £25 11s. 10½d. Ans.

STANDARD VI.

1. Reducing all the consumers in the consequent to their equivalent in girls, we have:—12 men = 22½ girls, 20 women = 30, 6 boys = 7½, + the 45 girls = 105 girls. Reading the question now as presenting girls only, and working by proportion and *cancelling*, we have—

$$\frac{18 \text{ days} \times 1 \text{ g.} \times 5 \text{ l.} \times 3 \text{ lb.}}{7 \quad \times 2 \quad \times 2} = \frac{270}{28} = 9\frac{9}{14} \text{ days.}$$ Ans.

2. £383 18s. 1½d. − £337 10s. = £46 8s. 1½d. interest.

£337 10s. ÷ 20 (5 per cent. being $\frac{1}{20}$) = £16 17s. 6d. *one* year's int. Then £46 8s. 1½d. ÷ £16 17s. 6d. = 2¾ yrs. Ans.

3. £150 = 6000 sixpences. And $\frac{1}{3}$ of $\frac{3}{10}$ of $\frac{3}{10}$ of $\frac{9}{10}$ of $\frac{9999}{10000}$ $=\frac{2}{3}\frac{7}{1}\frac{1}{0}\frac{9}{0}\frac{9}{0}=$ ·474609+. Ans.

STANDARD VII.

1. £1260 ÷ 80 = £15 15s. cost of each horse. £15 15s. × 25 × 1·6 (60 p. c. gain being 1·6 of cost price) = £630; £15 15s. × 30 × 1·4 = £661 10s.; and £15 15s. × 25 × ·8 = £315, the three amounts received for the horses, making together £1606 10s. Then £1606 10s. − £1260 = £346 10s., which divided by 12·6, the outlay in *hundreds* of £, = 27½ per cent. gain. Ans.

2. From the basis of discount, £85 would make the £1 19s. 8d. as int. in the required unknown time. At 4 p. c. £85 would make £3 8s. int. in a *year*, and £1 19s. 8d. is $\frac{7}{19}$ of £3 8s., hence 7 months. Ans.

3. As 30 per cent. was deducted from the second remainder, the remnant must be 70 per cent., or $\frac{7}{10}$ of the second remainder. And similarly the second remainder must have been $\frac{4}{5}$ of the first remainder, and the first remainder 82 per cent., or $\frac{41}{50}$ of the original sum. Hence $\frac{3}{10}$ of $\frac{4}{5}$ of $\frac{41}{50}$ of (£344 8s. =) $\frac{1722}{5}$ = £750. Ans.

Publications Reviewed.

Rules for the Mental Calculator. By F. J. Edwards. London: Swan Sonnenschein and Co.

If a fair proportion of such papers, as are reprinted at the end of the book, have to be answered, without the use of paper to work on, by candidates for training colleges, useful indeed would such a book be. Until we came to these papers and saw how much was expected to be done mentally we could scarcely understand the object of collecting the rules.

The book is rightly named 'rules, etc.,' for it is scarcely anything more; the word 'reason' is not mentioned until the 71st page, when the rules for finding the factors of numbers are not only given but explained, and in fact proved.

The rules are first given, then a single example is stated with its answer, and this is followed by the entire mental process carefully written out. To take an example. To multiply by such numbers as 121, 131, etc. RULE: Write down the *units figure* of the multiplicand and multiply by the TENS of the multiplier, adding to each result the figure to the LEFT and RIGHT of the one multiplied. EXAMPLE: 4,263 × 141 = 601,083. Ans.

Method: Write down 3, the units figure of the multiplicand. Four times 3 = 12 and 6, the figure to the left, = 18; write done 8. Four times 6 = 24 and 1 carried = 25, and 3 to the right and 2 to the left = 30, write down 0; etc., etc. Unless a student can follow the reason of such a rule, we cannot imagine anything more dreadful than to have to commit these rules—and there are 122 of them—to memory. We cannot help thinking that a line of explanation would often assist the memory immensely, and that many of the rules could be grouped together into one single rule—*e.g.*, To multiply or divide by any factor of 10, 100, 1000, etc.; why not say, Express the number fractionally with 10, 100, etc., as its numerator, and perform the operation implied? This would include a great number of the rules given in this book. The figure of Euclid II. 4 would impress the old rule, which by the way is retained in Rules 28, 29,—for finding the square of such numbers as 42 (40 + 2) or 38 (40 − 2), which we must think is better than that given in 27, 31, and 32.

Each rule ought to be followed by a few examples with answers at the end of the book. The thirteen or fourteen examination papers at the end of the book are not nearly enough of practice.

The book, especially the figures, is most beautifully printed, as indeed all Messrs. Sonnenschein's publications are—and on account of its cheapness ought to have a large sale with those going to training colleges.

Selections from Shakespeare's Merchant of Venice. By Thomas Parry, F.R.G.S.

Of the making codes there is no end, and of the books necessitated by them the end is still more clearly not yet. We suppose the series of thirty-five books issued by Messrs. Longmans are necessary. But we are not sure that they are not, in one sense, necessary evils. It is a little trying to the feelings to see Shakespeare cut about and transposed in the fashion that Mr. Parry seems to think wise. We cannot for the life of us understand why the first selections he gives are from the fourth act, and the next from the first. The book is disfigured also by two dreadful pictures. In the first Shylock is apparently about to wrap up a carrot in a pocket-handkerchief, and in the second he is tumbling down some steps, and suffering from an acute attack of colic. Mr. Parry, or the artist, would tell us that the carrot is a knife, the handkerchief the bond, and that in the second picture Shylock is going home after his unfair treatment by the Christian court. But the pictures are none the less not calculated to give children a high idea either of the intensely powerful situations of the play, or of the artist's ability.

Nevertheless, after this preliminary grumble, we admit that the work, once being necessary, it is well done. The account of Shakespeare's life, writings, grammar, versification are, as far as they go, quite accurate, and, allowing for the inevitable condensation, excellent. More than that, Mr. Parry has spoken out with no uncertain sound upon the central idea of the play. 'And so it was that Antonio thought it not inconsistent with his character to call the Jew ill names. 'Even at the end, when *rendering mercy* to the Jew, he attaches to it the spiteful, hateful condition that he shall "presently become a Christian."' Mr. Parry points out that the extension of freedom to Jews began with the French Revolution.

The explanatory notes are accurate, and the appendix on word-building, prefixes, and suffixes full and good. We cannot but think, however, that such an appendix would be rather terrific to a child. If we once grant that

Shakespeare should be read early in life (and this we personally are prepared to grant), and that he should be read in fragments (and this we personally are not prepared to grant), Mr. Parry's book may serve.

Latin Prose Composition and Translation for Senior Local Students. By R. M. Millington, M.A. Relfe Brothers.

The preface is almost, if we remember rightly, a verbatim reprint of what was said in the corresponding book prepared for Junior Local Students, which we noticed in a former issue.

Again the author has limited the space assigned for each paper, as given for the above examinations, to a page, thereby at times necessitating the use of anything but legible type, and in one or two instances reducing the notes to nothing but references to those of another editor.

When the papers are short, and the notes not too long, the printing is admirable, which perhaps manifests itself all the more by being found side by side with other and inferior efforts.

There are some capital sections at the end of the book as to the position of the relative, that of the subject, and other parts of a sentence, as well as an exhaustive list of connecting particles, thoroughly illustrated by examples from the best writers. This part of the book might be well enlarged by the introduction, as for the Juniors, of examples for practice. On the whole, the book will be found a useful supplement to any of the better manuals in use in our public and other schools, and supply a want not supplied by any with which we are acquainted.

Sight-Singing for the Code Grant (Old Notation).

Sight-Singing Exercises (Old Notation), for the Mundella Code Grant. By the Rev. Henry Roe, F.R.A.S. London: Marcus Ward and Co.

These books are written on the basis of the *fixed doh*, a fact which will, we think, exclude them from most elementary schools. For those who still adhere to this *fast-dying* method of teaching music, the books before us will no doubt be useful. They contain a large number of exercises, mostly in the key of C, with a few others in the keys of G, F, B flat, and E flat. So strongly is the author imbued with the principle of the fixed doh, that he calls these the keys of DOH, SOL, FA, SI flat, and MI flat. The exercises are graduated and arranged according to the divisions recommended by the Department; and the first of the books under review contains also a system of teaching sight-singing arranged to suit the requirements of each division. Each book includes the 'Instructions as to Examination in Singing,' recently issued by the Education Department.

Standard II. Physical Geography. By W. J. Stewart, B.A. London: Longmans and Co.

This is the first of a series of geographical readers intended to meet 'the requirements of Mr. Mundella's Code.' The author has aimed at simplicity in thought and in language, and has been fairly successful in respect to the topics he has chosen. The Code, unfortunately, requires of children of eight years of age a knowledge of the *size* of the earth: 'If a railway line could be laid down right round the earth, it would take a train which can travel one mile in one minute two weeks and a half to go all round the earth and come back to the place from which it started.'

This is a fair specimen of the style. The 'motions of the earth,' especially as the cause of 'the seasons,' we should certainly postpone to a later standard. There is a very apparent tendency, especially in the latter part of this book, to illustrate the late Sir Roderick Murchison's statement that geology is the foundation of physical geography. The engravings are numerous and the type is very suitable.

Paragon Readers. Primers I. and II. Manchester and London: John Heywood.

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Chapters in Popular Natural History. By Sir John Lubbock, Bart., M.P., F.R.S. National Society.

It is a foregone conclusion that any book of Sir John Lubbock's will display certain high qualities. A work by him is sure to be found eminently readable, graphic, and forcible, and at the same time clear, precise, and accurate in its science. All these terms may be fully applied to the work before us, and the National Society are to be thanked for having induced Sir John Lubbock to join the ranks of educational authors. The publishers are further to be congratulated upon the fact that they have not attempted to trammel their eminent author with any conditions. The facts of natural history are stated in a straightforward fashion, and no pretence is made at concealment of the fact that Sir John Lubbock is a full believer in the Darwinian doctrine of evolution. There is one serious defect in the book, however, arising, not from the writing, but from the arrangement of its matter. This is, that the principles to be illustrated are not made clear before the corroborative facts are set forth. Thus, pp. 112 to 154 are devoted to details respecting the fertilisation of flowers by insects. But it is not until p. 155 is reached that the explanation is found that the fertility of the plant depends upon the admixture of the pollen with the rudimentary seed; and even when something like an idea of this kind is conveyed, it is by no means given in so clear and plain a fashion that the young student of average intelligence cannot fail to understand it. Yet lacking this idea, the child wanders in a labyrinth without a clue, and misses both the interest and the value of what he reads. Such an omission would, of course, be supplied by a competent teacher; but we believe it would not have existed, had the accomplished author written the book throughout for its present purpose. It is really, however, an adaptation from Sir John Lubbock's previous works; and, whether made by himself or not, such a compilation cannot be expected to exhibit the perfection as an educational book which an original work might do. While thanking Sir John Lubbock for this work, therefore, teachers will hope that he may hereafter decide to write a special and entirely new volume for school use.

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An analysis of the play commences the book, which is terminated by forty general questions, and tables of prefixes and affixes. There are also a few woodcuts, which might just as well be omitted.

Our Little Ones. London: Griffith and Farran

This capital monthly maintains its high reputation. Our own 'little ones' quite look forward to its arrival with delight.

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Notabilia of English History. Third Edition. By Walter Blanchard, A.C.P. London: Thomas Murby.

The fact that this publication is now making its appearance in the third edition is a satisfactory proof of the favourable manner in which it has been received by teachers. Nor is this favour to be wondered at when one comes to look into the little book. Its chief features may be summed up in the words:—thoroughness and compactness. A large amount of information, most useful to teachers in preparing candidates for examination, is stored in its pages, and though of course the information given as to minor details is not sufficient to enable the manual to be used as a text-book, it forms a key to most, if not all, of those puzzling questions which are met with in examination papers, and will enable the teacher to readily frame questions on all the salient features of English History. Mr. Blanchard's Notabilia has our hearty praise.

Needlework and Cutting-Out. By Kate Stanley, F.R.B.S., Head Governess and Teacher of Needlework at Whitelands College, Chelsea, S.W. Edward Stanford, 55, Charing Cross, S.W.

Schoolmistresses will find this a very useful little guide in helping them to prepare their pupils for the individual examination in needlework and cutting-out now required by the New Code. Some very useful hints are given as to the best methods of giving *collective* demonstration lessons in these subjects, which, especially in some of the stages, will reduce the individual work of the teacher.

The book is evidently the work of a practical teacher who knows well the difficulties almost sure to arise at each stage, and who also knows some very good methods of coping with these difficulties. In the revised instructions to H.M. Inspectors, Article 9, they are requested to call upon pupil teachers and assistants to give oral lessons in teaching needlework. All likely to be so called upon, will find the hints here given very useful.

In the same circular, Article 7, special attention is enjoined as to the evidence of carefulness in teaching 'joinings' and 'fastenings' on and off, and to general neatness of finish. The most precise directions are given on these matters, particularly in the earlier chapters of the book, where they are most required.

To make this a complete handbook to the work of the needlework schedules, certain additions are required, such as directions for cutting-out shirts, both night and day, night-dresses, etc.; also full directions for teaching knitting. The writer has made no mention of needle position and knitting-pin drill, which H.M. Inspectors are expected to ask for in the infant classes. Perhaps she thinks, with ourselves, that this is for little ones not only an entire waste of time and effort, but that it is positively dangerous to put needles and knitting-pins into the hands of such tiny children.

We sum up by saying that what is done is so carefully and thoroughly worked out, that we think teachers would be glad to welcome this work as an entire and complete handbook to the needlework schedules of the New Code, which, with the revised instructions to H.M. Inspectors, are printed at the end of the book.

The 'Complete' Class Register. By John Morgan and Robert Bowker. London Agents, Jarrold and Sons.

We commend this new issue of the 'Complete' Register to all teachers of schools under inspection. It is large, clear, and conveniently adapted to a class of fifty scholars. By the insertion of a 'half-leaf' the full quarter's statistics are presented in a compact form. The weekly attendance, now so important, is progressively noted, and all that is needful under the New Code is apparently supplied. In the well-ruled copy before us, in paper boards, the lines of the separate leaves are carefully adjusted to correspondence. On the last page are the necessary schedules for the summary of the year's work.

The Analytic Arithmetical Test Cards. Code 1882-3. In six Standards, 2—7. By Robert S. Wood. London: John Marshall and Co.

We have pleasure in commending this set of arithmetical test cards as being carefully graduated and thoroughly practical. Great care has evidently been taken in selecting the work for each standard. The questions for the various standards are printed on cards of different colours, so that confusion as to the particular work apportioned to each standard is a matter of impossibility. The cards employed are of serviceable thickness, and those on which the answers are printed, in view of their constant use, are backed with linen, and may be described as being, with ordinary care, untearable.

Analytic Model Essays. In three Packets. Bolton: Robert S. Wood. London: John Marshall and Co.

We have examined the first set (Packet A) of these cards, and are satisfied that if they are used correctly they will lead to good results. Each packet contains twenty cards, on each of which is printed a model essay, divided into its sections, so as to guide the learner in his treatment of the subjects given in the exercise at the foot of the card. The method followed throughout of thoroughly subdividing the subject into its component sections, and then treating each section in detail, is, we are convinced, the only effectual way of teaching essay-writing; and the sub-division of the subject-matter has also the important effect of forcing the writer to look at the subject in its entirety before commencing, and also of checking that tendency to wander off into irrelevant matter which some are so prone to.

English Composition Test Cards. By A. Park, F.R.G.S. Standards VI. and VII. London and Edinburgh: W. and R. Chambers.

Though we are afraid that even yet in many schools the power of expressing thoughts in good readable English is considered to be inherent in youthful minds, and to need little or no encouragement or training, we are glad to note that this state of things is by no means so common as it was some few years ago, and that the importance of a proper study of English composition is becoming more and more appreciated. There is no doubt that facility in clothing one's thoughts in words, though to a certain extent a gift, may be cultivated to a very great extent. We have heard that a teacher once described his composition class as being composed of (first), those (only a few) who had both ideas and words; (secondly), those who had ideas but no words; and (thirdly), those who had no ideas, and consequently no need of words. This division will, we imagine, be acquiesced in by most teachers, but we trust for their sakes class three will be found a small one. It is for those falling under the second division that Mr. Park's cards will be found especially serviceable, as by supplying hints and 'heads' for the various parts of the subject, they afford a capital framework for the essay, and one requiring but little ability and command of language to clothe in suitable words. We hope Mr. Park's cards will have the circulation they merit.

English Composition for Standards VI. and VII. By A. Park, F.E.I.S., F.R.G.S. London and Edinburgh: W. and R. Chambers.

This little book is intended by the author to be a companion to his Test Cards, which we have elsewhere reviewed. It contains a series of thirty-six short and simple themes to act as models for the scholars, and to be reproduced from memory as far as possible by them. We certainly think if the author's hints, as given in the preface, with respect to the use of this little manual and the test cards are followed, considerable success will be attained in teaching a subject which has well been described as 'one of the great bug-bears of elementary education.'

Geographical Reader. Standard II. London and Edinburgh: W. and R. Chambers.

This is an excellent little volume, with subject-matter sensible and simply expressed, and printing and illustration all that could be desired by the most fastidious. The illustrations are indeed so good that the thought naturally crosses one's mind as to the advisability of presenting such really excellent work in a book intended for such youthful minds as those in the Second Standard of our elementary schools. Our own opinion is that the limit of art in the illustration of junior school books has long ago been reached by many firms, and that if the practice of illustrating such books with wood-cuts, which would not disgrace an *edition de luxe*, be persisted in, the children who use the books will see but little to admire when they grow up in works of a much more pretentious character.

Graduated Readers. Book IV. London and Edinburgh: W. and R. Chambers.

It would be difficult indeed to find fault with this capital book. It is serviceably bound, nicely printed, well illustrated, and full of interesting matter from the first page to the last. The selections have been made from all classes of literature, but whether prose or poetry, biography or anecdote, natural history or travel, they are one and all well adapted for children's use. The book may be strongly recommended as an attractive and useful school-book.

—o—

Notes on Bacon's Essays.

BY FRANCIS WATT, M.A.

ESSAY XLIV.—OF DEFORMITY.

SUBSTANCE.

THE deformed are frequently of bad character; but this is not necessarily so. In many deformity is not without its advantages, since it disarms adversaries: also rulers have shown a liking for deformed men, thinking them more useful. Some cases of deformed yet noble men.

even with Nature. As Nature has disgraced them, so are they a disgrace to Nature.

by them, to them.

Scripture saith. Rom. i. 31; 2 Tim. iii. 3.

a consent between the body and the mind, so Richard III.

> 'Then since the Heavens have shaped my body so,
> Let Hell make crook't my mind to answer it.'

ventureth, risks—this is the translation of the Latin that follows.

election, we cannot change our body, but we can our mind.

the stars, etc. According to the science of astrology, the stars which were in the ascendant at the time of our birth had a powerful influence on our after-life; but just as the sun is more powerful than the stars, so Bacon says that though our inclinations may be originally evil, yet good education and sound principle (*the sun of discipline and virtue*) may overcome them.

consider of, to look upon.

deceivable, deceiving—deformity very often, but by no means of necessity, is accompanied by evil inclinations.

anything fixed, an original bodily defect.

induce, tend to cause (*L. in*, and *duco*, I lead).

extreme, adv. extremely.

as being exposed. Bacon's use of the participle here, where we should use a dependent sentence, is very like the Cockney vulgarism 'through being,' etc.

somewhat to repay, if their obvious defects are pointed out they may be able to point out defects less obvious, but perhaps as unseemly, in their tormentors.

at pleasure, safely.

as never believing. We should here say 'since these never believe,' or some such phrase. Bacon's use of the participle gives emphasis and condensation to his style.

they should be. We should here use the present, and say 'they are.'

upon the matter, on the whole.

a great wit, a genius, a very clever person.

obnoxious and officious, subject and dutiful (L. *obnoxious*, liable to punishment, and so slavishly submissive; *officium*, duty).

spials, spies; so Spenser, 'He privy spials placed in all his way.'

reason, general rule.

the ground is, the fact or state of the case is.

which, the antecedent is the clause, *seek to free themselves from scorn.*

virtue or malice, admiration or fear takes the place of scorn.

prove, turn out.

Agesilaus was lame, and yet a great warrior. See note to Essay XL.

Zanger. He was the son of the Sultan Solyman I., called the Magnificent, who ruled over the Turkish Empire in the sixteenth century. Zanger died of a broken heart on account of family feuds and murders.

Æsop was said to be deformed. He was a Greek slave who flourished about the sixth century B.C. As already noted, Babrius is now credited with the authorship of the so-called 'Æsop's Fables.'

Gasca. Pedro de la Gasca overcame Pizarro, conqueror of Peru, and attained the supreme power in that country 1547.

Socrates (B.C. 469-399), though not actually deformed, was a miracle of ugliness: hence Bacon says he *may go likewise among them*; that is to say, may be included in the number of deformed men.

(*To be continued.*)

—o—

Julius Cæsar.

ACT II.

NOTES ON SCENE II.—(*continued.*)

66, *Genius.*—Soul, or the reasoning powers as compared with the bodily instruments through which they work. See Macbeth III., i., 56:—

> '——— There is none but he
> Whose being I do fear: and under him
> My genius is rebuked; as it is said
> Mark Antony's was by Cæsar.'

Spenser, 'Faery Queen,' ii. 12, 47:

> 'They in that place him Genius did call;
> Not that celestial powre to whom the care
> Of life and generation of all
> That lives, perteines in charge particulare;
> Who wondrous things concerning our welfare,
> And strange phantoms doth let us oft forsee,
> And ofte of secret ills bids us beware.
> That is ourselfe, whom though we do not see,
> Yet each doth in himself it well perceive to b .

The Daimon (δαιμων) of Socrates is the genius of Brutus.

68. *To.*—Pleonastic, *i.e.* unnecessary. *Find other cases.*

70. *Your brother.*—Junia, sister of Brutus, was wife of Cassius.

71. *Is he alone?*—A world of meaning in the question.

72. *Mo.*—More. A supposed plural form of more.

73, 74. So that the face is wholly hidden.

76. *Mark of favor.*—Trait of countenance.

77. *Faction.*—Party of conspirators. It is to be noticed that not a word has yet been said to Brutus as to a conspiracy of more than one. Cassius only has spoken. But his friend has pieced out his words and knows that the plot is manifold.

83. *Path.*—Walk. Some suggest 'put.' The four last words are an absolute phrase, rather than one before which 'with' is understood. The absolute case, *i.e.*, the case used in phrases not governed by or governing anything, is ablative in Latin, genitive in Greek, nominative in English.

84. *Erebus.*—Hades or the infernal regions had five divisions, of which this was one.

Enter the conspirators.—They have been to Pompey's porch.

88. Compare this impressive line with line 62 of this scene.

98. The question is a general one. Cassius in line 100 very wisely takes the answer on himself.

101. This conversation is to fill up time while the two main men whisper. But the discussion runs upon the dawn of the most eventful day for them, for Rome, for Cæsar.

104. *Fret the clouds.*—Mark them as with fretwork.

109. *Weighing.*—Considering.

112. He is resolved and Cassius has made him thus.

113. In this line and the next is a contrast between the natures of the two men. Cassius, more practical, knows that this crowd of men will be more bound by the ordinary oath than by any other means. Brutus, more theoretical, appeals to the higher thought that moves him, but does not affect them.

114. *The face of men.*—The aspect of the Romans around them, and by implication that of the time.

115. *Sufferance.*—Suffering. Compare I., iii., 84 of this play, and also 'Merchant of Venice,' Act I., Sc. iii. l. 111, where Shylock, using the more modern form, says, 'For sufferance is the badge of all our tribe.' Note the very natural break at the end of this line.

116. *Betimes.*—Early. The 'be' here='in.'

117. *Idle.*—Because now unoccupied.

118. *High-sighted.*—As the eagle, tyrant of birds, sees his quarry from high places and afar. *Range* is a falconry term for the flying after game.

119. *Lottery.*—The lottery of fate, not the casting of lots. Under a tyrant everything is of chance. Any one at any time may fall. *These.* Motives given in the first two lines of his speech.

123. *What.*—Why.

124. Ellipsis at the end of two words. *Supply them.*

125. *Secret.*—Capable of secrecy.

126. *Palter.*—Equivocate. Macbeth (v. 8, 20), speaking of the witches with their double meanings, cries—

'That palter with us in a double sense.'

And in Coriolanus iii. 1, 58 we have the word 'paltering' as a noun. To-day with us the adjective 'paltry' is the only form. Compare with all these Richard II. ii. 1, 60, where England is called by despondent John of Gaunt, 'a pelting farm.'

127. *Engaged.*—Pledged.

128. *This.*—Redress.

129. *Swear.*—In a transitive sense. *Find other cases of intransitive verbs used transitively. Cautelous.*—Deceitful; *cautela*, caution. Hence by an easy degradation the later meaning.

130. *Carrions.*—Corpses: for men not alive to sense of wrong.

133. *Even.*—Our enterprise is sedate, measured, though so tremendous. It keeps at a level, and that a high one.

134. *Insuppressive.*—Not to be suppressed. Compare in 'As You Like It,' iii. 2, 10, Orlando's last line in praise of Rosalind—

'The fair, the chaste, the inexpressive she.'

135. *Or—or.*—Either—or. Latin 'aut'—'aut.'

137. *Nobly bears.*—The reverence for high birth comes out even in Brutus.

(To be continued.)

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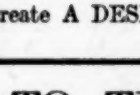

This new series of Reading Books will be found exactly adapted, not only to the latest requirements of the Mundella Code, but to the Syllabus issued by the School Management Committee of the London School Board.

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